JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXX., No. 2066.—TUESDAY, DECEMBER 16, 1902.

EDITORIAL NOTES.

Cheaper Gas for Paris at Last.

WHEN commenting, in the last number of the "JOURNAL," upon the rejection by the Paris Chamber of the Bill to sanction the Chamon scheme for effecting a reduction in the price of gas, we mentioned that the Prefect of the Seine had in reserve a project by which this much-desired object would be attained without imposing upon the city the very onerous financial burdens inseparable from the other arrangement. The casual remark dropped by a deputy, towards the close of the debate, that there was something on the cards, led to inquiries being made for information by both parties in the Municipal Council at the meeting of that body later in the week. Being thus directly appealed to, M. de Selves replied at once that the Gas Company were to be asked to lower their price from 30 c. to 20 c. per cubic metre (from 6s. 9d. to 4s. 6d. per 1000 feet); the difference between the two figures to be paid to them out of the Municipal Treasury. In the event of this proposal not being accepted, the consumers were to pay the Gas Company their full charge, and be reimbursed the 10 c. per cubic metre by the Municipality. If there should be insufficient funds for the purpose, they were to be raised by the issue of bonds to the extent of 40 million francs, as permitted by law. After a long discussion, this scheme was submitted to the Council in three resolutions, which were separately voted upon, and were all carried by substantial majorities. They were subsequently put *en bloc*, and agreed to—61 votes being recorded in their favour. When the Council reassembled on Monday last week, the Prefect of the Seine was in a position to announce that he had received from the Directors of the Company the assurance that they would assist in every possible way in the realization of the object sought; and they expressed the hope that their mode of procedure in the matter would be satisfactory alike to the Council and the consumers. The necessary steps are being taken to ensure the carrying out of the arrangement come to, as from the commencement of the New Year; and it may be presumed that it will continue in force until the expiration of the concession three years hence. It is needless to speculate as to what will then be done. It appears that a proposal has been submitted to the Chamber to invite tenders for the supply of gas to the city for a period of thirty years from 1906; the contractor to pay the Municipality at least 15 million francs per annum, and to charge the consumers not more than 18 c. per cubic metre for gas. In the event of the dividend exceeding 6 per cent., the difference would be divided between the contractor and the Municipality in the proportion of 40 per cent. to the former and 60 per cent. to the latter. We shall await with interest further particulars in regard to this project. Meanwhile, the consumers have the gratification of knowing they are to be relieved of some of the heavy burden which they have borne for so many years in the shape of an unusually high charge for gas, and which neither learned Technical Commissions nor Municipal Committees have been able to lighten. The problem which baffled them has, however, now been solved, apparently without very much difficulty, by one powerful official; and it may therefore be presumed that we have heard the last of the Paris Gas Question—at all events for a few years.

Professor Lewes's Prescription.

THE first three of Professor Lewes's Society of Arts Cantor Lectures dealt exclusively with illuminating gas and its applications to lighting; and therefore they constitute a body of doctrine directly and solely addressed to gas engineers and those gas consumers who wish to obtain the best value for money paid for this necessary of town life. It is a special mark of the times that the two interests are now, to all intents and purposes, fused into one. What with having the care of the latest improved arrangements for street lighting, and in so many cases also undertaking the supply and maintenance of incandescent burners in private use, besides the intimate relations established between suppliers and consumers of gas by prepayment meters, gas managers are so completely associated, as regards point of view of these matters, with their customers, that the superstition that it was ever otherwise only lingers in the dark places where the London County Council and the Metropolitan Gas Referees still appear to cultivate it. Professor Lewes's first lecture related to the ancient and the modern ideas of the proper way to get the best light from gas—tracing the change and development of these notions from the days when high illuminating power was deemed to be everything, down to the belief which has supplanted it in the greater importance of other factors in the formula for the best gas that can be manufactured and distributed for general purposes. Incidentally, the lecturer showed that when gas was of nominally high illuminating power the general body of consumers did not benefit from the fact. The whole thing was a convention of the photometer-room; and the people never saw even 16-candle gas, to say nothing of the higher powers. With the advent of modern burners the situation was entirely changed; and now it is the people who get 100-candle gas, and the photometrists who are supposed to watch over the quality of the article have no official cognizance of it.

As usual, the English public have been slow to benefit by their advantages. They are not given to study the small economies, and have thus gone on in the old wasteful way of using gas long after the more frugal Germans had abandoned it. They were not helped out of their ignorance and carelessness by their duly constituted guardians in these matters. No local authority is known to Fame for having assisted the people to reduce their gas bills. The London County Council could issue special instructions concerning the proper use of oil-lamps; but they have never touched gas as the light and fuel of the majority of the householders. The great reform has, however, been carried into effect without governmental or official countenance, and simply as a matter of business between suppliers of gas and their customers. A curious state of things has thus arisen in the gas industry—that while it is quite understood that the imaginary necessity for manufacturing gas of high illuminating power has vanished, there is as yet only a feeling about for something cheaper to take its place. It was part of Professor Lewes's object to contribute some information which might be useful for guiding this quest. Opinions will probably differ as to the degree of success he attained in this regard. He ranged himself uncompromisingly on the side of those who hold that the new standard British gas must be a mixture. His prescription, shadowed forth in his first lecture, and formulated definitely in his third, is that the gas of the future will have from 450 to 500 British thermal units calorific power, it will test 12 candles, and be made by adding plain water gas to the coal gas while in course of distillation in the ordinary way. In the dim and distant future, he sees carbonization upon the coke-oven principle superseding the present method.

This is not a conclusion which will commend itself to all gas engineers. It is no new advice on Professor Lewes's part; for he is known to have long had his own shoulder to the wheel with the hearty conviction that this is the way in which the British gas industry should proceed. If we mention an objection or two, it is not to disparage the prescription, but merely to mark points which it does not appear to cover. It will be difficult, to begin with, to reconcile all gas managers to the additional terror of looking after a mixing process. This is sufficiently troublesome when the gases to be mixed are pretty much alike, as ordinary coal gas and carburetted water gas. But when it becomes a matter of actually letting down the coal gas with an admixture of gas of no illuminating power whatever, and only about one-half of the calorific power, where is the bold gas manager who would lightly take on such a task, always supposing that his doings are tested by an official who is instructed to treat him with suspicion? What sort of tests, if any, would be regarded by such a manager with equanimity? The difficulty of advance in this direction—assuming, for the

sake of argument, its desirability—seems to lie in the want of some automatic means of proportioning the admixture, where the difference between the components is so great. Hence the thing needful appears to be a mechanical device, working in connection with a source of water gas which will give the product, hot, as and when required. It does not seem a small or an easy order to fill. Then as regards the ulterior prospect of assimilating the carbonization of coal for the gas, to the distillation of the same kind of coal for coke and other residuals, it appears to always keep retiring as various experimenters seek to approach nearer to its realization. It is the rainbow of modern gas manufacture. There is nothing to prevent the adoption of the plan forthwith, if it can be shown to be a gain in any respect on the existing practice. One need not wait until there is a call for 10-candle gas to bring in this method of gas manufacture. Why, then, does it remain at a respectful distance? The reason is that it has nowhere shown any gain in yield of gas, or saving of time, or space, or fuel. When the Everett plant was started, we argued that, as compared with ordinary gas making, it only appeared to offer change for a dollar. Now the change appears to have run short. We do not want to alter all our methods in order to be no farther forward. Change for a sovereign is not good enough. Something more must be thrown in, if only a small percentage.

Nothing but praise can be given to Professor Lewes's masterly statement of the latest information concerning mantles. The last is very far from having been said on the possibilities of incandescent gas lighting; but all that Professor Lewes advanced in this connection went to raise the importance of a uniform supply—which, again, goes directly against manufacture by mixing or with enrichment. It may be truly said that we shall never succeed in getting the best results with incandescent burners in England until all the gas is of about the same character. Everything in and about the burner is affected by the character of the gas, even to the size of the mesh of the mantle, as Professor Lewes remarks; and when once this cardinal fact is grasped, the disturbance caused by our varying standards of illuminating power can be realized. It is scarcely politic, in existing circumstances, to do more than call attention to that portion of the lectures which refers to the testing of gas for illuminating power. It is a coincidence that the publication of these observations should occur at the same time as the issue of the new Notification of the Gas Referees; and it is impossible not to read the one in the light of the other. Which light is to be preferred is, as the old rhyme about toasting the King and the Pretender has it, "quite "another thing." Altogether, as we remarked at the outset, these latest lectures of the gas manager's favourite guide, philosopher, and friend are eminently worthy of the lecturer and the subject; and the Society of Arts have rendered the community good service in procuring them at this important era in the development of the gas industry.

Oppression of Industrial Enterprise in Italy.

It is impossible for the directors and shareholders of English Companies who have invested their capital in Italy, with the countenance and consent of the governing authorities and for the benefit of the people, to sit impassive under the hardships to which they are now being subjected by those to whom they have a right to look for protection and assistance. But now, and for some time past, rights and just expectation are being, and have been, treated with unrestrained contempt, and all solicitation and efforts to obtain common fairness receive the scantiest of recognition and just a sufficient exhibition of amendment to show the outside world that the sense of justice is not altogether dead in those who administer the public affairs of the country. While there are signs that justice is not dead, the hope will be cherished that it is but sleeping, and that the dawn of a brighter day will again soon break for foreign industrial undertakings in Italy. Exotic enterprise holds a very large stake in the country; and it can only be imagined that this fact has much to do with the present movement, and that its ultimate object is to drive the foreigner away—throwing seemingly, in the achievement of the purpose, all obligations to the winds.

The report of the proceedings at the meeting of the Continental Union Gas Company published in this issue strongly illumes the present position of the relations of a foreign concern with the Italian people; and also the fact that no sooner is there fair promise of an escape from one trouble for an undertaking by means of skilful diplomacy and concession, than another comes in view. But fortunately for the shareholders of the concern named, they are not dependent for the bulk of their income upon Italy; but it is their possessions in that country that cause them the greatest trouble and anxiety. At every turn, in the last two or three years, new aggravating difficulty has met the Directors, who deserve, and have, the full sympathy of the shareholders. The position, in fact, has become well-nigh intolerable. There are two main respects in which the story unfolded at the shareholders' meeting illustrates the attitude of the high administrative powers in the country towards the class of enterprise as represented by the Company; and to them we will confine attention.

In the first place, Italy has its labour question; and in a form that it is some consolation to know is certainly rare in this country. To-day—as the papers have informed us, and Mr. Arthur Lucas, the Chairman of the Continental Union Gas Company, has confirmed—the relations between employers and employed in Italy are more strained than in any other country of Europe; and for this condition of things, the Government are largely responsible. Twelve months or so ago, the Company were suffering the bitterness of a strike; and then it was that the refusal of the Government to afford protection gave encouragement to workmen in many other parts of the country. The storm that has since burst over Italy has been largely the result of the Government's short-sighted policy at that time. But the Company in whom we are specially interested for the moment met their men in a lenient, conciliatory, and generous manner, which involved them in an increased annual expenditure of no less than £10,000. Even then, through the machinations and influence of the agitators (who make a living at the game in Italy as do a well-known few in this country), the men were kept in a state of unrest. Anyone who has visited certain gas-works in Italy during recent times will have seen that "an honest day's work for an honest day's pay" is a motto honoured by the men more in its breach than in its observance; and, in the case of the Continental Union Gas Company, the generosity of the Directors was not reciprocated by a fair return in work. So trouble has continued; but it is hoped that the men have now seen the folly of their attitude. A deputation from them has been visiting this country; and the Directors have afforded them every facility, aided by the courtesy of the respective engineers and proprietors, for visiting several large gas-works in England and Scotland. At these works, the men have been permitted to make their own investigations as to the character and quantity of the work performed by the stokers; and our gas workers will feel some pride in learning that they have sent the Italian delegates back to their own country a little staggered as to what Britons can comfortably do in the matter of retort-house work. It has, it is safe to say, been an object-lesson that they will never forget. However, to their credit be it said, they have accomplished their mission thoroughly and with intelligence—neglecting no means of obtaining the information they required. We sincerely hope that this visit will yield a better understanding between the men and their employers. But one thing is certain, that the former have exhausted the forbearance of the latter; and the Directors have given their word that no further concessions will be made on their part. The concession (if so it can be called) must be from the other side, by the rendering of honest duty.

The second matter which the Continental Union meeting brought into prominence shows the strong democratic spirit now pervading Italy. A Bill has just passed the Chamber the like of which in regard to the sweeping death-blow it aims at all private enterprise in the rendering of public service has never before been known. It provides for the purchase by Municipalities of all privately owned public services in which concessions have more than five years to run. Concessions, contracts, loyalty by the Companies to the letter and spirit of the terms of their concessions and contracts, are to be set at naught, if the Bill finally passes, and purchase, compulsory or otherwise, is to be within the power of all Municipalities. Even the scheme for the transfer of the Metropolitan Water Companies will not compare with this wholesale enterprise-extinguishing measure, the provisions of which, apart from the general power of purchase, seem, by the deliberate remarks at the meeting of the Continental Union Company, to be of supreme gravity

so far as the rights of the owners of the property proposed to be expropriated are concerned. True, some modifications in the Bill have been made, but of their character little has yet transpired. It is, however, clear that those in touch with Italian affairs do not—in spite of the friendly remonstrance against the measure that has been made from high quarters—entertain much hope of the amendments being of a nature that will afford any very great gratification. A few caustic remarks were made at the meeting regarding this oppression of private enterprise; but severe utterances at the present stage will not assist in producing relief. We may rest assured that, with Directors such as those who control from this country the affairs of gas enterprises in Italy, the utmost that can be done in protecting the interests of shareholders will be accomplished. In their hands, the position may at present be confidently left, with the hope that their efforts will be richly successful, if not in destroying the measure, in securing such provisions in connection with the terms on which purchase may be made, as will be honourable on the part of the Italian Municipalities, and fair to those who have invested their money in the country.

The Coal Outlook.

THE Board of Trade returns for November give additional force to the contention put forward in these columns recently, that the present position of the coal market is due to influences that must, in the nature of things, pass away in the course of no very long period of time—a fact which should, in our opinion, render coal buyers very chary of committing themselves at the present time to heavy forward purchases. We are desirous of emphasizing this opinion because the current issues of the coal trade journals contain reports of somewhat heavy sales of gas coal to foreign gas companies covering the next two years at prices very little below those being paid on current contracts, which are considerably above the lowest rates on record. Such reports have always to be accepted with reserve; but, if true, they do not reflect much credit upon the foresight of the buyers. The coal market at the present time is being kept in a condition of firmness (altogether at variance with the general trend of business in this country) by two factors, neither of which will be permanent. The one is the stimulus given to the exportation of coal by recent labour troubles in French and American coalfields; the other is the steady outflow of iron and steel to the United States, consequent on the failure of the supply there to meet the abnormal demand.

During the past month, the exports of coal amounted to 5,398,000 tons, compared with 4,632,000 tons in November of last year, and 5,008,000 tons in the same period of 1900. Of the increase over last year, 129,000 tons went to France and 215,000 tons to the United States; while the trade with other American countries was increased by reason of the stoppage of exports from the States. Altogether, the strikes abroad had, up to the end of November, directly increased our exports by about 850,000 tons, in addition to the indirect stimulus given; and the effect of the strikes, though they have been at an end for some while now, and no longer afford subject for sensational paragraphs in the daily Press, is by no means exhausted. In France, in the States, and in Canada, the supply of coal is still insufficient to meet what is just now the maximum demand, and the coalowners in this country are benefiting accordingly. The Spring will, of course, see the end of that state of affairs; and coal buyers should bear this in mind.

In regard to the exports of iron and steel, the influence of the state of trade in America continues as great as in former months. The net exports in November to all countries except the United States amounted to 159,600 tons, compared with 137,800 tons last year and 209,900 tons in 1900; but when the American figures are taken into account, the complexion of things is materially changed. During last month we exported 93,000 tons to, and imported 2300 tons from, the United States; in November, 1901, the figures practically balanced one another; in November, 1900, we imported 67,700 tons from that country, and only exported thither 6600 tons—so that the reversal of trade compared with two years ago affected the general balance in November by some 150,000 tons. Over the eleven months, the effect has been to change a net importation of 155,000 tons from the States in 1900 into a net exportation to the States this year of 625,000 tons, and to increase the total net exports to all countries by 350,000 tons compared with last year. This is equivalent to an increase of 1,000,000 tons in the exports of coal. The latest reports from America point to a continuance for some months yet of the demand for iron from this country; raw iron and the coal required for making it being still scarce, while the demand continues practically unabated. The increased volume of traffic is compelling the railroads to lay down additional lines and to build more rolling-stock as fast as possible; and the orders already given out for these purposes ensure activity in the iron and steel trades for a considerable time to come. But before many months are over, the productive capacity of the iron-works will have been increased very materially, and better supplies of fuel will be forthcoming; and so soon as the supply gets on terms with the demand, British iron, handicapped by a heavy tariff, will not be able to compete with the home product.

Apart from the stimulus given by the orders from America, the iron and steel trades are in by no means a flourishing condition, nor is there any prospect of improvement in the near future. Trade generally, moreover, is decidedly quiet. There is, therefore, every reason to believe that next year the coal market will be in a condition far more favourable to buyers than it is now or has for some time been, unless it is in the meantime thrown out of gear by labour troubles; and a waiting policy is certainly the one to be commended. So far as the several labour difficulties that overhang the coalfields are concerned, there is very little at present to report. In Scotland, the men have been granted a small increase of wages—which were at the minimum—and matters are consequently quiet there. In South Wales, the negotiations are dragging on slowly; and it is difficult to forecast the upshot—perhaps a temporary settlement only will be effected, which would be a decided misfortune. In the Federated area, Lord James of Hereford has found it impossible to decide between the conflicting claims of masters and men without further investigation; so that it will be some little time before the wages question is settled there. It is to be hoped that, if the award is eventually against the men, there will not be the trouble that there was over the last reduction; but miners entertain very strong objections to adverse awards. Taking everything into account, we conclude, as we began, by saying that this is not the moment for making engagements for far-ahead requirements. The end of the winter may see a considerable brightening of the outlook.

Case of the Unemployed.

FOR some time past it has been growing more and more evident that the employment market was weakening. The conclusion of the South African War brought back many hands, while the consequential cessation of the orders for war material made work very slack in many quarters. When, on the top of all this, a spell of frost came to stop building and interfere with all ground and waterside labour, the raising of the old cry about the "unemployed" was inevitable. Accordingly, the cry has been heard in the land; and all the stock company of Labour agitators, who do not labour themselves, and are never so prosperous as when others are idle, are mustering for a grand revival of the great days of 1889. The more sensational newspapers have already begun the publication of harrowing accounts of destitution in the East-end of London and elsewhere; and the Trade Union Councils have met and declared their intention to create an agitation on the subject. A question has been asked in the House of Commons by Mr. Keir Hardie; and it may be safely concluded from all this that, as the French say, "the trick is in the bag." Of course, the Socialists and their Trade Union echoes want something done. They do not precisely know what, and do not greatly care, so that the public money flows like water in channels of their contriving. But this noble band forget that the cry about the unemployed has been heard before. The matter has been looked into, and the subject is better understood now than it was when Mr. Tom Mann and others were all for adjusting the length of the working day to the purpose of absorbing the unemployed. The existence of a constantly unemployed residuum of the population is recognized by men of the world, just as are other sores of the body politic; but as the trouble seems to be incurable, so it is not commonly talked about. In all such cases, there are times when public attention is attracted to some special manifestation of what is always just beneath the surface of every-day life; and then there is a great rush of people to make something out of the opportunity.

It is very easy for vague persons to point to the existence

of wandering bands of unemployed men as the reason why Parliament should instantly vote something handsome for the relief of the vagrants. The truth is either overlooked or is not known that, for reasons which it would be impossible to go into briefly, a percentage of those who are already poor deliberately prefer the life of vagrancy, with its attendant hardship. This was the weakness of the Tom Mann proposal. Even though the hours of all adult men's labour were reduced by law to four a day, or less, there would be able-bodied vagabonds who would not work those four hours every day, week in, week out. Habits of periodical drunkenness, physical weakness, or mere fancy, keep up the average of the permanently unemployed. While work is plentiful, these unattached loafers manage to get along somehow; but, of course, whenever there is a spell of hard times, so that numbers of genuine working men are thrown out, a condition of crying distress is very soon arrived at by the agglomeration of the worthless and the deserving. Then is the time for the former to share in whatever measures of relief are intended for the latter. Wherever big compassionate schemes are hastily floated, it is the professional loafer who is first and oftenest at the gate of charity; just as it is the professional working man's friend who invariably stands in for all the praise and the pudding he can get out of the spasmodic generosity of the ignorant rich. Whatever real good can be accomplished is most likely to be effected by the regular agencies established for ameliorating the hardships of the genuinely miserable and destitute. Yet, such is human nature, these are liable to be entirely overlooked in the course of agitations which are started and engineered by people who are either green at the job or have their own axes to grind.

In the present circumstances, it is highly desirable that the general public should keep a cool head, and scrutinize the credentials of all those who are clamouring for help for the unemployed. Mr. C. S. Loch, the Secretary of the Charity Organization Society, who knows as much about this subject as most, vouches for the fact that there is as yet no very great or exceptional distress—certainly nothing that the existing and ordinary machinery for the purpose cannot deal with, if allowed a little more help. The past few years have been marked as a time of plentiful and well-paid work, and the ordinary labourer has been able to treat himself to a bicycle and many other conveniences and even luxuries. It would be really deplorable if just a week or two of frost and slackness of work here and there were to plunge all these comfortable and "independent" people into abjectness. At the same time, it may not be wasted effort to remind those who have it in their power to employ labour that a little trouble devoted to find work for those who need it in the depth of winter is well bestowed. By so doing, they will also more effectually checkmate the endeavours of professional labour leaders to make political—or social—capital out of a spell of hard times, than could be done by any amount of argument or denunciation. Controversialists may dispute to any length over the precise meaning to be assigned to the circumstances of workhouses being full and "refuges" nightly overflowing. The endless dispute as to whether relief agencies attract more applicants than they assist may be left to people who have nothing else to do besides writing to the newspapers, if only those who are in a position to provide honest work will form the determination never to turn away an applicant for employment if they can possibly help it.

Some Metropolitan Matters.

THOSE who have regarded the average Londoner as being indifferent to his responsibilities and opportunities in the matter of local government can bring forward much strong evidence in support of this impeachment; but there are exceptions to most rules, and some of the Metropolitan Boroughs are displaying a good deal of liveliness in the field of local politics. The rates and electric lighting are burning questions at present in some of those huge boroughs which are really big towns in themselves. It will not be surprising if in several instances the question of electricity supply proves to be the touchstone of local politics. Those of the London Municipalities which have gone in for electricity supply are only just feeling the weight of the obligation, and some of them already would be heartily glad if they could be relieved of the burden they took upon themselves so lightheartedly. There is no great haste being now displayed in adding to their number. Marylebone has received the blessing of a heavy arbitration, as the first-fruits of its enterprise in this direction. For it has been agreed on all hands that the two leading principles of the Electric Lighting Act, 1882—municipal preference and competition between systems—are incompatible. Competition in electricity supply exists in different parts of London; but no municipal undertaking is permitted to compete with a private concern. This condition, of course, puts a steadying weight on Municipalism. To have to buy out an electric lighting company before going into the business with the ratepayers' money, is an obligation to make a merely adventurous local authority think twice about it. It means at least that such a body must face at the outset, and in the lump, a financial commitment which others are let into by instalments.

In Camberwell, there has arisen a strong public opinion against the undertaking of electricity supply by the Borough Council. The Council seem to have been rather inclined that way; but the ratepayers got up a deputation to interview them about it, and supported it in such numbers that the public gallery was stormed and the partisans of the enterprise overwhelmed. It would be necessary here for the Local Authority to buy out the Brush Company at a cost of something like £140,000, for what has hitherto failed to bring in much (if any) profit. There is another Company in the district as well; but neither Company have very much prospect of doing good business. They cannot stand against the South Metropolitan gas; and, in addition, the few large business establishments in the locality which use the electric light have their own private plant. So the Companies, not unnaturally, think they would like to sell out to the Borough Council, which contains a few men silly enough not to see through the scheme. One member prattled of what profit the Council would be able to make when they had got their dust destructor to work! He was promptly outvoted. There has been a Special Committee of the Council, apparently with some prominent ratepayers helping them, engaged in investigating the question; and they went very strongly against the purchase proposal. They found, in the first place, that the ratepayers do not want the electric light, and that the streets could not be lit by it except at a prohibitive cost. Consequently, it became a question, What was the use of the scheme? This pertinent query was answered unmistakably in the negative by the common sense of the people. The incident says a very great deal for the principle of directly consulting ratepayers on such important matters as the one alluded to.

Scope of Operations of the Standard Oil Company.

A CONSIDERABLE amount of feeling seems to have been displayed in some quarters in regard to the refusal of the Indian Government to grant oil concessions in Burmah to the Standard Oil Company. The local representative of the Company has been complaining to the Bengal Chamber of Commerce as to the treatment received by them from the Government, notwithstanding the philanthropic cast of their offers with respect to the concession. Readers of certain "Trust" literature will enjoy this claim of the Standard Oil Company to benevolent intentions. It is now reported, moreover, that the representative of the Company has been using language in Bengal such as only a very angry or a very puny sovereign power dare use in regard to a rival power. We are not even sure that the gentleman did not go so far as to aver that the American Eagle should scream, at his instigation, over this check to the national genius for trade expansion. We do not believe all the stories that are told of the Standard Oil Company; but buyers of gas oil are not particularly anxious to see this pushful concern in possession of all the oil in the world. It is getting very near this, as time goes on. The Standard Oil Company are one of the great powers of the commercial world, which cares far more for a "combine" than it does for a king. If the Standard Oil Company wanted to buy all the Russian oil there is, they could probably do it, even though it might be necessary to buy over the Russian Empire first. And supposing all the oil in the world to pass ultimately into the possession or under the control of the Standard Oil Company, what would be the result to the trade and the consumer? For that is, after all, the important question. Would the putting of all the petroleum supplies into a single ownership or Trust make the commodity cheaper or dearer? The Standard Oil Company would probably say the former; but others may have their doubts. It is a knotty problem.

The Exhibition that Has Failed.

Blind persistence in the folly of struggling with an obviously inflexible opposition, produced by the discontent with previous experience, has brought what can only be described as disastrous failure to the promoter of the Lighting, Heating, and Smoke Abatement Exhibition, proposed to be held during the Christmas Season at the Crystal Palace. Well would it have been for him, and no one can now know it better than himself, if he had listened to the reasonable advice tendered to him by those who had knowledge of the feeling of the gas industry and of its manufacturers in connection with his scheme, and dropped at all events the section for which, to make it a success, the interest and support of the latter were necessary. However, perversity in face of general objection, has brought about the expected fiasco, if last Saturday's beggarly preparation fairly foreshadows the final display. Saturday was the day announced for the opening of the exhibition, both on the lists of "Forthcoming Exhibitions" at the Palace, and on gaudily coloured posters. But in the newspaper advertisements of the Palace events to which reference was made on Saturday, no statement appeared regarding the exhibition. However, duty claimed attendance; but a diligent search only resulted in the discovery of half-a-dozen unfinished stands, on only three or four of which were exhibits. The Chemical Engineering Company were in evidence with a few samples of their goods; a firm of manufacturers of acetylene appliances were making a display. Messrs. Nicholls and Co., of Hove, were exhibiting a patented form of cooking and heating apparatus, to which a wonderfully concocted and unpronounceable name has been applied; and there was a stand on which were shown some highly ornate stoves, which, we take it, represent the "support" of the Smoke Abatement Society. Whether the next few days will produce something more, we cannot say; but the preparations do not justify any expectation that they will. Under such circumstances, it is hardly necessary to say that there is no occasion for readers to specially spend money on a visit to the Palace to see the Lighting, Heating, and Smoke Abatement "Exhibition." The word is quoted inasmuch as we do not desire to be accused of a misapplication of the term.

The Prospectus and the Result.

When writing on the subject of the proposed exhibition three months ago, it was remarked: "The prospectus of the exhibition held last year aspired to great things; the present one, if anything, exceeds it. Will the aspirations be fulfilled?" The signal failure is the answer; and, while we felt sure success would not attend the venture so far as the gas industry was concerned, the result beats all anticipation. The prospectus stated that the exhibition was to be under the control of an Executive Committee of the Smoke Abatement Society and the "Society of Gas Engineers." The latter Society was supposed to be the Midland Association of Gas Managers; but there was no justification for making use of a title of a non-existent Society, or to assume that the Midland Association as an organization were going to lend their support because perhaps one or two individual members had been approached. The assurance was also given that the "distinguished patronage" then already obtained for the exhibition would be a sufficient guarantee of its future success. Throughout, the prospectus was drawn in chromatic language, its aims were varied, and its general terms seductive. Now, so far as the gas industry is concerned, we may fairly, in view of what was presented on Saturday, ask for the justification of the statements made in the prospectus, and at the same time an explanation might be given as to what has happened to prevent a representative display in the heating and smoke abatement sections. If something more than the shadow of an exhibition is not going to occupy the south nave of the Palace, then the sooner the present stands cease to take up space the better; and then, in view of the assurance as to success in the prospectus, any payment and expense to which the half-a-dozen or so exhibitors have been put should, in fairness, be refunded. For assuredly by remaining they will only subject themselves to ridicule. Our own previous action in connection with the preliminary announcement concerning the exhibition was merely the expression of the general feeling of the gas industry on any repetition of a privately organized exhibition; and until one is floated on a proper and recognized authorization, the columns of the "JOURNAL" will not be devoted to its support. The prospectus already alluded to mentioned that a "Great International Exhibition" is in course of formation for 1904. The "Organizing Commissioner" of the present failure, of course, knows his own business best; but unless that exhibition, so far as the gas section is concerned, is controlled and organized by (say) the Institution of Gas Engineers, then it is safe to predict that its fate will be similar to that of the present one.

A Golden Dream.

It is a well-known saying that there is nothing new under the sun; but on catching sight of the heading to an article in our contemporary "Tit-Bits," we were inclined for a moment—but only for a moment—to think that the exception had been found which was to prove the rule. The title referred to was "Can London be Lighted Free?" and naturally we imagined that the writer of the article would proceed to prove that it could. What was our disappointment, therefore, to find that the only means he had to suggest of conferring such a benefit on the pockets of the ratepayers was the fine old idea of harnessing the running water, the tides, and the wind for the purpose of securing power. The proposition is an attractive one, as many scores of people have thought, long before ever the writer in "Tit-Bits" turned his attention to the subject. But up till now, except in a comparatively few instances where the conditions have been particularly favourable for generating electricity by this means, no practical results have been achieved. "Tit-Bits," however (apparently under the impression that someone might have a workable scheme "up his sleeve"), has sent a representative to call on several "prominent men," to solicit their opinions on the matter. These opinions are interesting; but unfortunately no one seems to have had anything at all to suggest. The example which is dangled before the eyes of expectant readers is that of the Niagara Falls power station; and though, of course, "Tit-Bits" does not profess to be a scientific publication, it should be hardly necessary to point out that there is a vast difference between these falls and the mouth of the Thames as a source of power. Other installations, indeed are named; but most, if not all, of them refer to waterfalls or running water, and not to tidal rivers or the sea. Where the power is intermittent, an initial difficulty is placed in the way of its use; and, needless to say, if the energy has to be stored, away goes at once the suggestion of "free lighting." No; we are much afraid that, for the present at all events, the ratepayer of the Metropolis must put from him as nothing more than a pleasant dream the idea of getting his public lighting done for nothing. The contributor to our contemporary imagined the reader of his communication asking at the commencement, "How is it to be done?" Well, we have carefully read the article through, and at its conclusion the very same question arises again to our minds —"How is it to be done?"

A Bid for Unpopularity.

An article which appeared in the "Pall Mall Gazette" last week draws attention to what must be termed very high-handed treatment by the London Electric Lighting Companies of their consumers with regard to the recent change of pressure from 100 to 200 volts. It will doubtless be remembered that a Board of Trade inquiry was held two or three years ago as the result of a very widespread feeling that the consumers were put in a less favourable position by this change, while the Companies gained an immense advantage. The result was that the Board granted the consumers full compensation for the expense of making the change, and for incidental damage or loss caused thereby. But according to the "Pall Mall Gazette," the conditions imposed by the Board of Trade appear to be too onerous for the Companies; and they have therefore been obliged to invent other methods of harassing their old consumers, and so driving them to make the change. The action of the Chelsea Company, as being one of the worst, is taken by our contemporary as an example; and certainly they do seem to be treating their old consumers in a very shabby way. The Company long ago refused to connect any new consumers except at the increased pressure, for which the price was reduced; and the 100-volt consumers were offered this lower rate if they would convert their installations

at their own expense. As this offer did not seem to have the desired effect, the price to the latter consumers was raised from 6d. to 7d. per unit. This, however, is not all. Within the last few weeks, the 100-volt consumers have been favoured with a circular from the Company stating that they are willing to exchange the lamps and make the other alterations necessary for a change to 200 volts, if the consumer will sign a paper binding him to continue to take a supply for three years at a cost of 6d. per unit. At the expiration of this period, they say they will supply him with current at the reduced rate. We quite agree with our contemporary that this a most unfair proposition, and that the treatment by the Company of their old consumers is of anything but a generous character. Apparently the Chelsea Electricity Company are unaware of the disadvantage of making themselves unpopular—to put the matter on a no higher footing—but that this will, if they continue in their present course, be brought home to them in time, there cannot be a shadow of a doubt. Why is it that private companies will persist in playing into the hands of the municipal trading advocates in this way?

The Danger of Overrunning the Constable.

The very proper rebuke administered to the Urban District Council of Rhyl, on the occasion of the inquiry held by Mr. R. H. Bicknell, on behalf of the Local Government Board, into an application for sanction to a loan of £9000 to cover money overspent on their electric light undertaking, as reported elsewhere, should be taken to heart by other local bodies. It is by no means uncommon, when an electric lighting or some other scheme is in hand, for those who are carrying it out to be a little too free with the money, and to considerably exceed the estimates, in the confident expectation that a loan to cover the additional expenditure will be readily sanctioned by the authority at Whitehall. Mr. Bicknell has disabused the Rhyl people on this matter; remarking that he was not there to inquire as to money already spent, but to see how that which had been applied for was to be laid out. The Town Clerk (Mr. A. Rowlands) acknowledged that he had been told very much the same thing for the past twenty years. But he pointed out that the Council were empowered by Act of Parliament to ask the Local Government Board to allow them to raise loans for "defraying any costs, charges, or expenses incurred or being incurred on public works;" and he said he had satisfied the Inspector's predecessor on the point. Mr. Bicknell replied that he would never be satisfied that any authority had the right to borrow £14,000, and overspend it by some £9000—the largest excess he had ever known. Mr. Rowlands pleaded that the money had been lawfully spent. No one questioned it for a moment. All the Inspector suggested was that it had been spent "improperly." Other places will do well to note the difference in the words, and hesitate before following Rhyl's example.

WATER AFFAIRS.

Progress of the London Water Bill.

The result of a good day's work by the House of Commons on Monday last week, coupled with the suspension of the twelve o'clock rule, was the completion of the Committee stage of the London Water Bill. In view of the fact that on the previous Friday the Committee had disposed of only four out of the fifty-two clauses, and that there were upon the paper a large number of amendments on which there was a probability of considerable discussion taking place, the result was almost unprecedented. All the talk about fighting the Bill line by line went for nothing; and the very thin attendance of members on the Opposition side of the House was powerless against the force at the back of the Government. True, Mr. Long had made some concessions, and others were promised; and this, to a certain extent, disarmed his opponents. There was, nevertheless, plenty of attack and defence; and the outcome was that the Bill was reported shortly after midnight. On Wednesday it was considered by the House on the report. At the very outset, an unsuccessful attempt was made by Mr. Cremer to wreck the Bill by moving the omission of the first clause, dealing with the Constitution of the Water Board. This gave Mr. Long an opportunity of explaining the changes he had made. In Committee, the Board had been reduced by taking away five members for Metropolitan Boroughs; and by a rearrangement of some of the outside areas he was able to add four to the representation of the London County Council, making their number fourteen. The Chairman and Vice-Chairman will be elected by the Board; and in this way the total membership will be reduced to 66. The "appointed day" for the transfer of the undertakings has been changed to the 24th of June, 1904, "or such other "day as the Local Government Board may appoint;" and the Companies are to receive "compensation" for the loss of their property, and not merely "consideration," as the original Bill stood. The time within which loans are to be repaid has been extended from eighty to one hundred years from the 31st of March next, and provision has been made for the equalization of the water-rates. The House was engaged practically the whole of Wednesday on the clauses; the report stage being concluded between ten and eleven. On the motion to read the Bill a third time, Sir Charles Dilke opened a fresh attack upon it; and he was followed by other Metropolitan members. Mr. Long then replied. He told the House that it was easy to criticize and condemn his proposals; but he took his stand on the solid fact that no others had been successful. He concluded by expressing the hope that the people of London would find the Bill a real and a lasting solution of a question that had for long troubled the country. The motion was carried shortly after midnight.

The Bill thereupon went up to the Lords, and was read the first time; the second reading being moved on Friday by Lord Balfour, the Chairman of the Joint Committee who considered it. Opposition was renewed in the Upper House, the attack being led by Lord Tweedmouth, who moved the rejection of the Bill, on the sole ground of the constitution of the Board. He urged the claim of the London County Council to be constituted the authority to manage the Metropolitan Water Supply. To them and not to the unwieldy body proposed by the Government, who would have unlimited powers of raising money for which they would only be indirectly responsible to the ratepayers, this important service should, he contended, be entrusted. Lord Balfour defended at some length the Bill and the action of the Joint Committee in dealing as they had done with it; but he could not satisfy Earl Carrington that London wanted or liked the Board which it would bring into existence. Viscount Llandaff confessed that there were many things in the Bill which he disliked—one of them being that though it was concerned with a transaction involving a large expenditure in the purchase of property against the owners' will, they were excluded from the operation of both the Arbitration Act and the Lands Clauses Acts—a privilege accorded to the humblest landowner whose ground was to be taken from him compulsorily. Another objection he had to the Bill was the constitution of the proposed Board, which he contended should be one composed of experts. Lord Avebury joined in the condemnation of the Board, and predicted an increase in the cost of water under its management of the supply. Lord Monkswell, as Vice-Chairman of the London County Council, naturally supported Lord Tweedmouth, especially as the Council had condemned the Bill. However, the second reading was carried by a majority of 33; and the Bill was committed for yesterday.

Though in its progress through the Lower House the Government measure has undergone considerable modification, there is room for further amendment; and several notices having this object stood upon the paper for consideration in Committee of the Lords yesterday. One provision liable to misconstruction to the Companies' detriment was pointed out by Mr. Tendron, the Chairman of the Grand Junction Water Company, at their half-yearly meeting on Wednesday last. As mentioned above, the Local Government Board may appoint another day than the one named in the Bill for the transfer of the Companies' undertakings; and one would naturally infer that a subsequent day is intended. But, as the Bill left the Joint Committee, there was nothing to prevent an earlier date being fixed. This ambiguity has now been removed.

With regard to the attitude of the London County Council towards the Government Bill, they are thoroughly disgusted with it. By the adoption at last Tuesday's meeting of a long report of the Parliamentary Committee criticizing it, and declaring that the passing of it would be attended by results

which they feared would prove "prejudicial to the best in- "terests of the water consumers and ratepayers of London," they have, as they consider, set themselves right with the ratepayers (who probably will not care a straw about the matter), and washed their hands of the whole business. It is to be regretted that, on this question of the water supply, the Council have displayed too much of the disordered condition which the Americans call "swelled head;" and because they have not been allowed to have exactly their own way, they are "in the sulks." The attitude they have lately assumed is neither becoming nor dignified in a public body; and we are greatly surprised that a prominent member like Sir William Collins should advocate resistance to the Water Board by declining to send any representatives, and more so that he should have been supported by Mr. M'Kinnon Wood. A much more reasonable course was taken by Mr. Burns. The honourable member for Battersea has far too much common sense to waste time over the useless task of resisting the inevitable; and when the inevitable happens, as in this case, to be the frustration of a cherished desire on the part of a body of which he is one of the most industrious members, in connection with a project in which he has figured conspicuously, he does not "sulk," like a spoilt child who cannot have its way, but at once philosophically adapts himself to the circumstances, and determines to make the best of them. His example may be commended to others—in Spring Gardens and elsewhere.

Pipefounders Charged with Negligence by Water Engineers.

THE pipefounders of the country should take seriously into consideration the questions raised by Mr. W. H. Humphreys, of York, in the paper which he read, on "The "Coating of Cast-Iron Water-Pipes," at the winter meeting of the British Association of Water-Works Engineers, and which questions were emphasized in the discussion; for it cannot be to the interest of any pipe-making firm that part of their workmanship should be held accountable for giving their customers annoyance, and their customers' consumers any distress in the matter of water supply. The paper and the discussion may be summed up as a charge against pipefounders of negligence or of the employment of improper or inadequate methods in connection with the coating of water-pipes; and, from that point of view, they cannot afford to let the matter pass unnoticed. The cases of trouble arising from badly coated pipes, as quoted by Mr. Humphreys, are not by any means isolated ones. The discussion has only to be read to find that defective coating imparting to water an unpalatable taste is an occasional experience of most of our water engineers; and consequently it may be assumed from this that failure at times in respect of the coating is not confined to merely one or two foundries. This being so, then the question introduced by Mr. Humphreys is one that is of equal moment to the pipefounders as to the pipe users; and it would be politic for them, in view of the statements made by the water engineers, to institute within their own walls a careful survey of the methods adopted in the finishing of their pipes, to assure themselves that, in not a single particular, is there a deviation from the system that should uniformly give a hard and durable coating to their pipes—particularly internally.

The bottom cause of the trouble appears to be that pipe-dipping is regarded as a process that can be perfunctorily performed—perhaps not so regarded in every foundry, but in many; and perhaps not by the principals, but by those to whom the operation is entrusted. The process is composed of many details, each of which is necessary to a satisfactory final result, and each of which demands the exercise of care. There is the quality of the constituents of which the solution is composed, their proper and thorough admixture, the consistency of the mixture, and the question of the temperature of the composition; and all of these points need constant attention to see that uniformity in every respect is maintained in order that similar results may be achieved. Then, too, there are questions affecting the pipes; and there does not seem to be any adherence to a general rule as to when they should be dipped, nor as to their condition in regard to temperature and surface soundness and cleanliness. Now all these are matters that should not be left to workmen without adequate supervision by some responsible person. It is suggested that water authorities should have paid inspectors at the foundries to see all these operations thoroughly performed. The idea is fully justified by experience; but it is rather a reflection upon pipe-founders, or their system of conducting some of their operations, when customers, for their own protection, go to the length of requiring the presence of a representative in order to see that the founders' men are not remiss in their duties, and that the methods employed are beyond question.

Of course, the retort may be made that water engineers are not themselves altogether free from blame in this matter; and that some of the complaint is due to the fact that specifications are faulty, and that the engineers do not allow sufficient time between the coating and the pressing of the new pipes into service. The variations in some of the specifications of water engineers in regard to coating are amusing; and it is not every water engineer who knows precisely what is the composition of the dipping solution as prescribed by Dr. Angus Smith. While there is truth in all this, it does not apply to the serious instances referred to in Mr. Humphreys' paper; and therefore the question is one for further inquiry, and the formulation of definite rules for the coating of pipes. We do not know whether the Committee of the Association shun investigations; but the author of this paper suggested at the last annual meeting that they should look into the question of electrolysis, and do something to help forward the movement for securing protection for pipe-owners. Nothing was done in regard to the proposal. In the present paper—in connection with the indefiniteness of the constitution of the pipe-coating composition and the manner of applying it—Mr. Humphreys urged that reliable data should be obtained by the Association, and a standard adopted and recommended for use by pipefounders in order to obtain uniformity of practice. At the meeting no one on behalf of the Council rushed at the proposition; on the contrary, it was politely evaded—there being only one or two meagre references to it. But in the suggestion is the preventive of further trouble—if, after acceptable rules had been framed, the pipefounders took adequate steps to see that they were strictly adhered to. The question need not be laboured. There is proof of good cause of complaint of the want of uniformity in performing an important process; and the complaint having been publicly made and confirmed by the experience of more than one engineer, the pipe-founders themselves should, in their own interests, give the matter due attention. For, after carefully considering the paper and the discussion, we cannot help feeling that the question dealt with is a serious one—for the pipefounders, for water engineers, for water consumers, and for those who have to pay for the shortened life of the pipes through defective coating work.

Watchfulness of the Local Government Board.

The care with which the officials of the Local Government Board go through the plans deposited with them of works for the carrying out of which local authorities apply for loans, was well exemplified the other day in connection with a water supply scheme promoted by a Rural District Council in the North of England. An Inspector was sent down to hold a local inquiry, at which the Engineer explained what it was intended to do with the money to be borrowed. After hearing him for some time, the Inspector pointed out that at a certain distance from the source of supply, the plans which had been sent to the Local Government Board showed the supply-pipe 2 feet higher than the source of supply. This indicated that the matter had not been properly considered. The Engineer, who was apparently much astonished, explained that one of his assistants got up the scheme. But the Inspector asked who was responsible for it, and the Engineer was then compelled to admit that he was. In reply to a suggestion which was made for getting over the difficulty of levels, the Inspector explained that he was there to deal with the scheme as sent in to the Board; and this was an absurd one—it was practically impossible. He then proceeded to show, by indicating other weak points in it, that he had thoroughly mastered the scheme. Though all this must have been somewhat of a damper to those responsible for the proposal in question, it will doubtless be a comfort to ratepayers to be assured that their interests are so well watched by the Local Government Board. It should also induce engineers to always make quite certain that the schemes they submit to the Board are not prepared in the loose way disclosed in the present instance. So far as the great majority of engineers are concerned, the warning, we know, is needless; it ought to be so in every case.

ESSAYS AND REVIEWS.

MUNICIPALITIES AND DEPRECIATION FUNDS.

In continuation of the abstract published last week (p. 1530) of the important paper dealing with this subject which Mr. C. H. W. Biggs read before the Society of Engineers, we notice to-day, as promised, some of the points made by the speakers in the subsequent discussion which are of most interest to our readers. The speeches were many, and long; and opinion was by no means all on one side. Mr. Biggs's contention was that the insistence upon depreciation as well as efficient maintenance and repayment of loans in regard to corporation concerns was absurd; and that the only likely motive for suggesting the need for such provision was an insidious attempt to handicap the undertaking because it was a municipal undertaking. This view, it will be seen, was severely handled by the very first speaker in the discussion (Mr. H. Sherley Price). At the outset, the President (Mr. Percy Griffith) asked those who intended to take part in the debate to put from their minds the general question of the municipalization of speculative and trading undertakings. He said that the main points arising out of the paper for consideration appeared to him to be these: What is the proper basis on which to deal with the item of depreciation in municipal undertakings? and How far are companies and municipalities comparable in this matter?

The Secretary (Mr. Perry F. Nursey) then read a communication received by Mr. Biggs from Mr. Young, the General Manager of the Glasgow Tramways, in which the writer said he had always held that the repayment of debt had nothing to do with depreciation, which must be provided for, in addition, out of revenue. In the case of a non-productive concern like a sewage scheme, there was no depreciation, and the longest possible term of years should be given for the repayment of the loan—say, sixty, seventy, or even eighty years. But in connection with this scheme there might be machinery for pumping; and provision should be made out of the annual revenue for the replacement of this machinery in thirty years, and depreciation on buildings should also be provided for. With regard to productive works like a tramway undertaking, he might say that in Glasgow they first of all met their ordinary working expenses; but in addition to this they charged revenue with £450 per mile of single track to meet the cost of renewing the permanent way. This was calculated on an average life of ten years. They also charged revenue with depreciation of buildings, plant, and equipment; and this kept up the undertaking in its original condition. Out of the balance, they paid interest on capital and sinking fund. Regarding depreciation, he did not see how the author arrived at the conclusion that, where depreciation was provided for in addition to the sinking fund, the result would be at the end of the life of the undertaking: (1) All loans repaid; (2) undertaking in perfect working order; (3) money on hand equal to the original capital. He (Mr. Young) held that at the end of this period the result would be: (1) All loans paid off; (2) undertaking in perfect order, or cash available to put it in perfect order. They might have to renew the lines three times over before the capital was repaid by means of the sinking fund.

As mentioned above, the first speaker was Mr. H. Sherley Price, who said that the author had expressed his desire for a common ground from which they could discuss the question of depreciation. He thought Mr. Biggs had found one (though perhaps unconsciously), in a phrase in his paper which formed the only solid ground upon which they might build approximate views regarding depreciation—he referred to the phrase "useful life." For brevity's sake, he would omit non-productive works which did not come into competition with private firms or companies to any very serious extent. He would treat both municipal and company works as being alike; their objects were the same—to supply a public need in the best possible manner at the least cost, and (although this might be disputed) to make a profit. The great difference between them was that the subscribers to the company found the necessary capital voluntarily, relying on the management to recoup them for their outlay; whereas the ratepayers had practically no voice in the matter, but must perforce supply the sinews of war. Now, to manufacture any article in quantity, at the lowest cost, necessitated using the best possible plant and machinery. This point was of extreme importance as bearing on the question under consideration. Depreciation not only comprised the lowering of value incidental to wear and tear, but it also included reduced value by reason of "obsolescence;" and it was chiefly this latter point which in times past English engineers had unfortunately greatly neglected—to their loss of profits, as well as of trade. But to neglect this feature in modern municipal and company enterprise, would be sheer madness. To illustrate his argument, Mr. Price pointed out that, since the introduction of electrical tramways, there had been some thousands of steam and horse tramcars thrown upon the market—in perfect working order, but no longer of use to their owners. These had had to be sold for less than one-tenth of the price at which they stood in the books. This might be considered an extreme case; but, particularly in new industries, improvements were constantly being made, and in such instances depreciation must be sufficient to provide against this. Improvements in electric light and power station equipments during the past six or seven years had resulted in an economy of from 10 to 15 per cent. in cost of generating and distribution. These costs varied in amount with the size of the undertaking; but taking a concern with a turnover of £50,000 per annum, a saving of from £5000 to £7500 annually would result from using machinery of the latest type. At the present time, said Mr. Price, there were to his knowledge numerous plants not ten years old, representing many thousands of horse power, being replaced by new, for this sole reason—lack of economy. When these plants were installed, they were up to date; but obviously, no matter what they cost, it did not pay to use them now. Then depreciation had to provide, not only for obsolescence, but for wear and tear; and this, again, depended upon maintenance. Hence, it was impossible to fix upon any rate of depreciation which was capable of uniform application. Referring to the tramway undertaking which the author of the paper had quoted as an example, the charges had been divided under five headings. The first was interest, which represented in a private undertaking profits. This, however, was a financial matter, which he would leave accountants to deal with. The next was repayment of capital. It seemed to the author a hardship that capital had to be repaid by corporations in thirty years, because he thought that at the end of this period the original undertaking would come into the possession of those who would not have contributed towards its cost. He (the speaker) had, however, grave doubts as to anything of the sort happening. If they examined any undertaking of the kind, they would find every year considerable sums expended in additions not contemplated in the loan, and too often nothing, or a very inadequate sum, set aside for replacements. There was remarkably little in the way of tramway plant or rolling stock that would last even fifteen years—or half the term allowed for repayment. Yet he found in the paper no reference to a fund for replacements. The third and fourth items—depreciation and maintenance—were, Mr. Price contended, the same; they were, in fact, inseparable. The rate of depreciation and maintenance should be sufficient to cover the "useful life" of the objects depreciated. In other words, when the objects could no longer be used economically—no matter what was their working condition—they should be discarded, and replaced by up-to-date objects; and this provision for wear and tear, maintenance, and obsolescence must be met out of revenue, and not out of capital. He was astonished to find that the author of the paper did not allude to a reserve fund, except in a vague manner as being mixed up with depreciation. It was, however, quite a distinct matter. He (Mr. Price) had argued that depreciation should cover wear and tear, maintenance, and obsolescence; but he had never yet heard anyone advance the theory that it should also cover replacements. The replacement of worn-out and obsolete plant should be provided for by a reserve fund, which was the only way in which it could be met on a sound economical basis. Still keeping to the example of the tramway, suppose in seven or eight years' time much of the line had to be re-railed. How were they to do this? The depreciation fund would have done its part by reducing the value in the books to a minimum; but they would want cash to purchase new rails. If they added the cost of the new rails to capital account, they would be committing suicide from any sound economical point of view, because they would show in their capital account that they had got the value of two sets of rails. And if this went on for thirty years—the length of the loan—the capital account would show that they had three or four times the value of the rails, although they would then have only the same quantity in use as they originally started with. Were it not for the provisions laid down by Government, he feared that many corporations would speedily get into a parlous financial state, for they were none too eager to carry out the conditions laid down.

Mr. Price was followed by Professor Henry Robinson, who said that, with reference to the question of depreciation, he thought nothing could be more important than to take into account who it was that designed the work. If a man who possessed no sufficient knowledge designed a structure, it would not last so long as one that was properly designed. Efficient maintenance, too, was an important factor. Another point was what he called "human fallibility." Works might be designed with the utmost care, and then they might be handed over to someone who, in a fit of mental aberration, might so treat them as to speedily put them in the way of destruction. In his own work, Sir Henry said, he always allowed for the possibility of some idiots running the plant for a time in a way in which it was never intended to be run. He agreed with Mr. Price that plant which was now quite up-to-date, might very soon become obsolete; and therefore he thought that it was very unwise not to lay by a sufficient reserve. Alderman Pearson, of Bristol, remarked that, as Chairman of an Electric Lighting Committee, he considered that he had to hold the scales evenly between (1) the ratepayer of to-day, (2) the ratepayer of the future, and (3) a gentleman not much thought of—namely, the consumer of to-day. In common honesty to the consumer, they ought to consider the least sum they could take out of his pocket which would enable them to carry on the concern without risk to the ratepayer of the future. But he certainly thought they should call upon the consumer of to-day to protect the ratepayer of the future from the possibility of abnormal claims being made upon him. His Committee considered the question of depreciation; and they

thought that, so long as the Local Government Board proceeded on the present lines—that was, calculating the life of the various works, and then equating them—practically no depreciation was necessary. They, however, followed this up by a resolution to the effect that it was advisable that no sums of money should be appropriated for the benefit of the citizens in the reduction of rates until the reserve fund was absolutely full—the limit in Bristol being fixed at 10 per cent. But he would like to see his Committee provide, in addition to the reserve fund (which should not be touched for small renewals), a fund which would enable them, should any untoward incident occur, to deal with it without trenching on the reserve, and also without trenching on the pockets of the ratepayers. In his opinion, Mr. Biggs was in the main correct when he said they had no right to ask the consumer of to-day to provide for the absolute redemption of every penny borrowed to start the works within a period (say) of 25 years; to keep the works in useful working order, and leave them in that state at the end of the loan; and, in addition, to accumulate in the shape of a depreciation fund a sum equal to the cost of the works in the first instance. They must put up cheerfully with the burdens they had to carry; but to attempt to add to these burdens the "huge incubus" of providing what he might call a sinking fund twice over, was more than they ought to do.

The next speaker (Mr. S. F. Morse) remarked that the terms on which municipalities borrowed money were for its repayment by an annual sinking fund. What was a depreciation fund for? It was to provide money to which resort could be had in case of necessity for various purposes connected with the undertaking; but the essence of a sinking fund provided by contract was that it should be invested carefully, so that at the end of the period it should equal the capital which had to be repaid. If depreciation was desirable (and he thought no engineer would suggest that it was not desirable), they could not get it out of a sinking fund; and there must therefore be a separate fund. Repayment of capital was not depreciation. It was what it expressed itself to be—the carrying out of a contract entered into by, or imposed upon, an undertaking as the condition upon which the capital was granted. Depreciation was necessary because the plant did depreciate; and in the electrical industry it depreciated very rapidly. Mr. Morse also ridiculed the idea of the author of the paper, that $3\frac{1}{2}$ per cent. was a fair return for a shareholder to expect from an electric lighting business. Other speakers included Mr. W. W. Beaumont, who said Mr. Morse wanted the capital repaid by a certain period, and he also wanted a sum provided which should be apparently equal to that capital. It seemed to him (Mr. Beaumont) that this meant the providing by one generation of a present for a succeeding generation.

In the course of a brief reply to the discussion, Mr. Biggs said that his idea of maintenance was the same as Mr. Young's. Mr. Morse, he remarked, did not seem to recognize that he had included maintenance as a necessity, and that this maintenance must be efficient. If these conditions existed, and the undertaking was up to date, would they have depreciation besides? He could not see why they should put another sum aside. Mr. Biggs said he thought it would be better if the Local Government Board would adopt a system, when granting loans, of distinguishing between those parts of a works which deteriorated rapidly and those which lasted longer.

ELECTRIC LIGHTING MEMORANDA.

Points for Gas Companies' Opposition to Local Authorities' Provisional Order Applications—The Mistaken Progressive View of Municipal Trading—A Bad Case at Newport (Mon.)—The Distribution of Electricity in Bulk in South Wales.

It will not be amiss to remind Gas Companies that this is the season when they must decide upon their policy in regard to applications by the Local Authority for Electric Lighting Orders. They will, of course, be advised as to the steps to be taken to obtain a hearing on these proceedings; but stress should be laid upon the precedent of the protection secured by the Gas Company in the Bermondsey case, and incidentally upon the Rhymney Valley case. The idea in both is the same, and is simply that any losses incurred by the trading speculations of the local authority should not come out of the rate fund. The undertaking should be self-supporting, with proper guarantees that this condition is fulfilled. On the other hand, it is only fair that no profits should be paid in aid of the rates. In short, there should be no connection of any kind between an electricity supply undertaking of a local authority and the rate fund of the district, for the reason, among others, so forcibly put recently by Sir Edward Clark. Apart altogether from any question of the right or wrong of the subsidizing of rates out of trading profits, the prospect and promises of such grants-in-aid is a bait which will make ratepayers swallow anything in the shape of municipal adventure. Consequently, the policy of the matter does not receive proper consideration; and headstrong local authorities, under the guidance of persons of "advanced" views, get committed to all sorts of ventures which, on reflection, they would never have touched.

The "Progressive Party" in municipal politics anywhere is bent on getting these profits. Their journals argue for nothing else. They are always showing how the rates of various places benefit from the profits of trade. Of course, there is no proof of a single instance of the kind; for the simple reason that there is no saying what the rates of a district ought to be without adventitious aid. Still, the Progressive cry is for profits—always the profits. The consideration of general expediency is entirely lost sight of; and yet it is the only one that determines the acceptability of any project of the kind. There are plenty of grounds on which expediency can be shown for various extensions of municipal effort; and it is the knowledge of this truth that prevents statesmen from going against the idea on principle. Progressives, however, totally misunderstand this fact. They point to examples of municipalities doing and supplying all sorts of things, with the sanction of Parliament; and they argue that, because of this, there is no case at all against municipal trading enterprise of any kind, especially if an estimated profit can be shown for it. They are doubly wrong, first in making a point of the profits to be made, and, secondly, in holding that municipal interference with trade is always positively justifiable and expedient if the municipality is disposed that way. The contrary is the truth. Municipal action requiring parliamentary sanction lies under the onus of requiring specific proof of expediency every time. The presumption is dead-against it. Away from this salutary rule, there is no good reason why a municipal corporation should not own and run a brewery, a bakehouse, or a clothing store.

A very striking example of municipal trading in practice is furnished by the proceedings of the Electricity Committee of the County Borough of Newport. On October 29 last, this Committee duly reported to the Council the quarterly statement of the Office Manager, which showed the cost of generation and distribution to be 2·65d. per unit. There is consequently no possibility of mistaking or misunderstanding the fact. Yet a month later, on the 26th ult., the Committee reported an application for electrical power which the Borough Electrical Engineer recommended should be supplied at 1d. per unit net. The reason given for this exceptional offer was that the motors would be in use day and night. It was resolved that, provided the consumer was prepared to guarantee a consumption of 100,000 units per annum, and that the motors used would be worked continuously, this should be the price charged for the supply. The minimum yearly bill at this rate would be £416 13s. 4d. How this transaction can be justified on the Committee's own accounts, we should like to learn. Even making all the proper allowance for the load-factor in the case, it cannot be done for the money. Therefore, the ratepayers of Newport are taxed in order that this particular customer of the Corporation may have power at less than cost price. Not much of a profit trading in this! But the transaction cannot, it seems to us, be defended on any ground. The excuse that the preference given is not an individual one, but that any other consumer of the same quantity would receive similar treatment, only makes the matter worse. The bare fact is that, but for this act of the Corporation, this ratepayer would be unable to get his power at anything like so low a cost; and this is a piece of injustice to others. Before quitting the subject, we desire to make use of it as a lesson to gas undertakings as to the sacrifices which managers of electricity supply undertakings are prepared to make in order to get a long-hour power connection. Why, the Newport Gas Company could better afford to sell their gas for the same class of consumption for 6d. per 1000 cubic feet. They could certainly do it for 1s. per 1000 cubic feet with less certainty of losing money. This Newport case is a very gross example of the lengths to which a Municipality will go in competition with a Gas Company; and some notice ought to be taken of it by the Official Auditor or somebody. But, unfortunately, it does not stand alone; and if a Royal Commission on Municipal Trading is ever appointed, doubtless a remarkable body of evidence could be produced before it to illustrate the ways of electricity supplying local authorities.

We have seen a couple of very interesting reports furnished by Messrs. Herbert Lewis and Fletcher, Electrical Engineers, of Cardiff, on the proposed electric lighting of two rural districts in Glamorganshire, which are instructive as recommending that the supply should be taken in bulk from the South Wales Electrical Power Distribution Company. This is the first case of the kind that has come under our notice. The consultants dismiss, as prohibited by cost, the alternative plan of the rural district authorities making their own electricity. The Company would agree to bring their mains to one or two distributing centres in the district, where they would transform the high-voltage current to a usable pressure for $\frac{1}{4}$d. per unit over and above the charge for the uncoverted current, which is fixed at $1\frac{3}{4}$d. per unit for quantities of less than a million units per annum. The Council would have to find these stations and pay for the attendance necessary. There would have to be an agreed minimum rental. In the circumstances, the task of the Council is much simplified. Their advisers take the prudent course of casting their estimates of first and working costs, and then finding how much business would be required to be done in order to make both ends meet. This is an unexceptionable way of stating the case; and local authorities so advised cannot plead that they are misled in any sense. They have as good knowledge as the Engineer—perhaps better—as to whether or not (and when) this equilibrium is likely to be reached. In the present case, it is reported that there is a reasonably good chance of this result being attained—no date fixed—provided a so-called free-wiring scheme is adopted. It is a funny term, seeing that the Council are advised to wire houses "free of cost," but to charge an extra 1d. per unit for doing it!

SOME HINTS AS TO REINFORCED CONCRETE CONSTRUCTION.

THE question of the trustworthiness, and consequently the acceptability for important engineering and building structures, of the combination of steel and concrete which has become so fashionable a structural material, by various names, is largely a matter of the effective preservation of the metal in the mortar integument. If it is true that the steel is effectually kept from rusting by the cement, then the strength of the construction will tend to increase with age rather than to diminish. If, on the contrary, the metal should perish in the interior of the concrete, then Time has in preparation a number of unpleasant surprises and mortifying disappointments for those who have trusted in the combination. Several considerations tend to enhance the importance of this consideration. In the first place, the construction itself is usually so slight that there is little surplus strength in the metallic component. This is really the principle of the system, by whatever proprietary name it may be known. No more metal is employed than is needed; and it is in pieces of small section—consequently, very liable to corrosion.

Moreover, the cement concrete is usually gauged so poor that it is not impervious to water. Consequently, we get the case of tank and other walls, conduits, and vaults, the strength of which depends almost wholly upon the integrity of small pieces of buried metal which are out of sight, but not beyond the reach of moisture and acid vapours. This is, of course, while the construction is as sound as it can be made. But should there be cracks in the walls, the risk of corrosion of the metal reinforcement will be much greater; and very few concrete structures escape cracking. The thorough study of the subject leads one into ramifications which would hardly be suspected at the outset. To begin with the original state of the steel. How is it with most of the metal that is put into these combinations? Is it clean? Not clean in the chemical or laboratory sense of the term; one is sure of that. The cost of really cleaning iron or steel for structural uses would be prohibitive. Besides, it would not be worth doing. The quickness with which clean steel takes rust is almost like that of the propagation of fire in a combustible structure. Anyone can see this for himself in the state of steel railway metals left unused for a few hours. The effect of this is that, while the number of protective coatings for structural steel is legion, and some of them would doubtless be effectual if they were applied upon the steel, as a matter of fact the coating is put upon rust or mill-scale or dirt, not on the metal at all.

There is no protection in mere thickness of metal. Thin as are the pieces of metal in reinforced concrete, the probability is that they are more likely to be effectually covered and preserved from corrosive agents than stout pillars and girders. There have been plenty of examples of rapid corrosion of thick steel plates built into bridges and frames, where perhaps a half-inch plate has lost one-eighth of an inch of its substance in five or seven years. The difficulty and doubtfulness here are as to how far the corroding action can be expected to go. Some engineers consider that the formation of a coating of rust on a steel surface is the beginning of a process that will go on until the whole is oxidized. Others regard this as a pessimistic view, and hold that rusting, while it cannot be wholly prevented, may be checked and retarded almost indefinitely by subsequent protective treatment. There seems to be no question that, in a reasonably dry place, the rusting of steel is an extremely slow process. This still leaves the question very controversial as regards tanks and other structures with constantly or recurrently wet surfaces.

It has been said that the essentially alkaline nature of portland cement must form a protection to the metal embedded in it. This view is, of course, reasonable; but it remains a fact that steel embedded in portland cement concrete has corroded, while other steel in a similar kind of concrete has not corroded. Examination of several examples of expanded metal reinforcement has revealed rusting wherever the steel was exposed through cracking of the concrete, even though the cracks were extremely fine. To exhibit the matter systematically, an American experimenter made up several kinds of concrete—some with cinder and clinker aggregate, and others with sharp sand and clean broken trap rock. The mixtures were gauged all the way from neat cement to 1 in 7. The steel used was pickled clean, and put into the middle of the bricks of concrete. As time would not permit of exposing these specimens to natural conditions, they were shut up in tin boxes and treated to various artificial atmospheres of steam, carbonic acid and air, and so forth. The bricks were also steeped for a time in water. After three weeks of this trying treatment, the bricks were broken up, and the state of the steel investigated. The neat cement specimens were all perfect—the metal being as bright as when it was first put in. Certain unprotected pieces of steel, put through the same ordeal for the purpose of comparison, were found to consist of rather more rust than steel. Of the remaining specimens, hardly one had escaped serious corrosion. The location of the rust spot was invariably coincident with either a void in the concrete, or a badly rusted piece of cinder. In the more porous—that is, the poorer mixtures—the steel was spotted with alternate bright and badly rusted areas, each clearly defined. In both the solid and the porous cinder concretes, many rust spots were found, except where the concrete had been mixed very wet, in which case the liquid cement had coated the steel like a paint and protected it. Some briquettes made later of finely ground cinders and cement in varying proportions, when exposed to moisture and carbonic acid, showed how effectually the presence of cement prevented rusting, even in a highly porous mass gauged 10 to 1—provided there were no cracks or crevices or distinct voids.

From this investigation, several conclusions are drawn which are likely to be of instruction to those who are attracted by the new fashion in construction. First, it seems proved that neat portland cement, even in the thinnest layers on iron, is really an effectual protection from rusting influences. Secondly, concretes used with reinforcement, in order to prevent the latter from rusting, must be dense and free from voids or cracks. They should also be mixed quite wet. Thirdly, the corrosion found with cinder or clinker concrete is mainly due to the iron oxide in the cinders, and not to the sulphur. Fourthly, cinder concrete—if free from voids, and well rammed while wet—is as protective of the embedded steel as clean stone concrete. Lastly, the cleaner the metal when used in this way the better. Pickling in dilute acid, followed by lime water, is recommended. The importance of these observations is obvious, especially in regard to the light they shed upon the behaviour of cinder concrete in contact with steel, and the wet mixing and ramming.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1641.)

BUSINESS on the Stock Exchange last week was quiet on the whole, except in one or two special lines. The settlement was the chief feature; and it does not seem to have brought any difficulties in its train. The tendency in prices wavered and oscillated a good deal from day to day; but at the close it was all in favour of taking a brighter view of things. The Funds were up, but Rails were down, and Americans very flat indeed. In the Money Market, there was a good demand in connection with the Stock Exchange and other requirements; and it was generally satisfactory that no increase in the Bank-rate became imperative on Thursday. Business in the Gas Market was a good deal quieter than it had been the previous week for some reason or other, possibly owing to the more interesting field afforded by Water securities. There were only a few changes in quotation; and these were about equally balanced between the ups and the downs. One incident, however, calls for special comment. We have before now had occasion to remark upon the unreasonably wide figures—frequently a margin of five points—at which stocks are quoted on the London Exchange, a practice which does not rule the Provincial Exchanges. But the incident of last week beats everything. On Wednesday for the account in Commercial old, only two transactions were marked; and the prices were quoted 250 and 259. Dealings like these have a disagreeable appearance; and they ought not to be possible. In Gaslight issues, business was very quiet, and devoid of feature. The ordinary opened at 85½, and changed hands almost daily at that figure. The secured issues, too, were very steady, and commanded firm prices. South Metropolitan was a little more active, and seemed at one time inclined to pick up. But it dropped to 116½ instead, with a reduction of a point in the quotation. There were a few more dealings than usual in the Suburban and Provincial group; but there was no movement in prices. The Continental Companies were as quiet as the rest, but were generally firm, except Continental Union. Imperial was steady and European fully-paid advanced in value. Tuscan rose a point. None of the remoter undertakings offered anything to notice. In Water, the progress of the Government Bill roused all the London stocks into life, and almost every issue rose at once by leaps and bounds—sometimes ten points at a time. There were not very many dealings at first; but they increased considerably later in the week. Whether any large quantity of stock has actually changed hands is another question.

The daily operations were: Gas was quiet on Monday. European rose ½. East London Water gained 1. Tuesday was still quieter. Tuscan rose 1, but Commercial old fell 3. In Water, the ordinary stocks rose from 5 to 10 each. Gas was still very quiet on Wednesday. Commercial old fell 4½, and South Metropolitan 1. Water stocks repeated their advances of the previous day. Thursday and Friday's operations in Gas were very slack; and quotations remained without further change. On Saturday. Gaslight debenture rose 1. Water stocks during the last three days continued to rise, and closed as shown on the list at p. 1641.

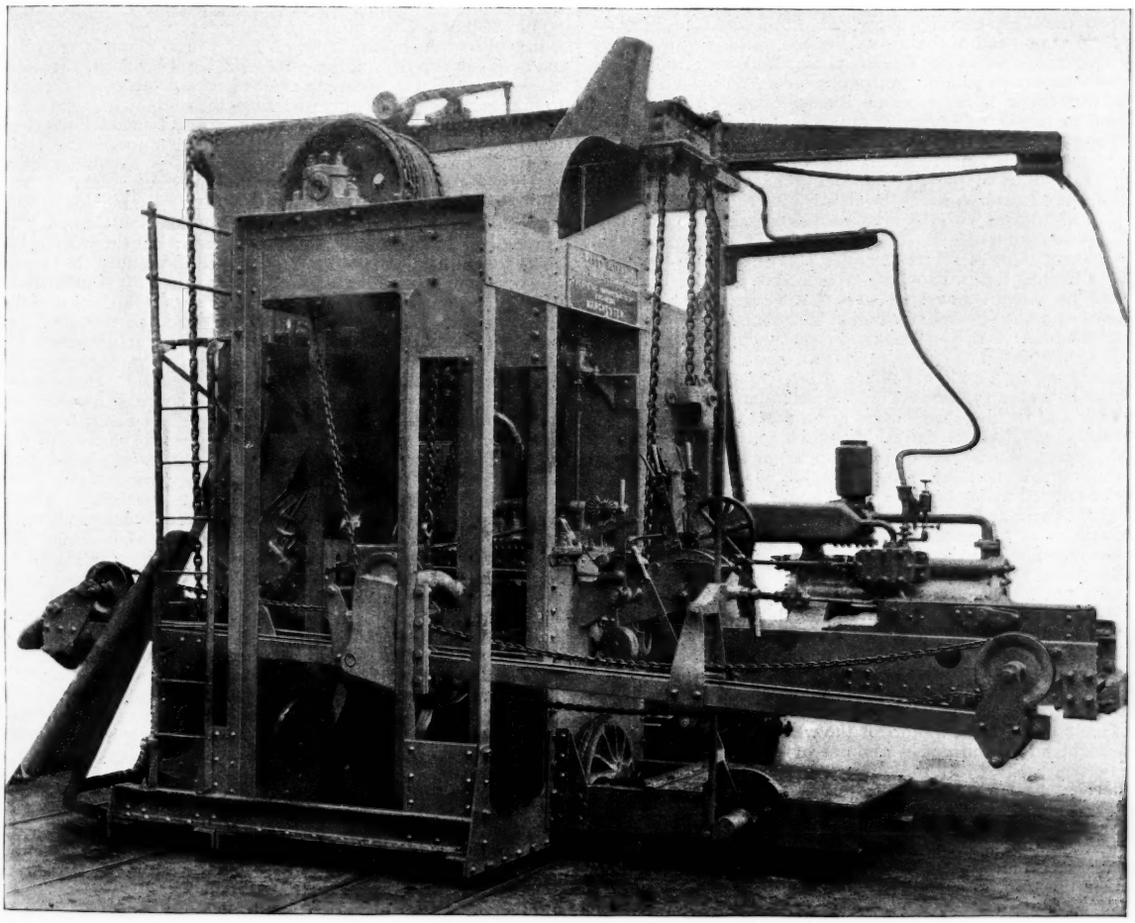
Professor Lewes's New Course of Cantor Lectures.—The final lecture of this series was given at the Society of Arts last night, when Professor Lewes directed the attention of his audience to the "allied illuminants" which, as announced in the title, were to be dealt with by him. He traced the advance made during the past fifty years in lighting by means of oil, and then showed how this light-giving agent could be utilized in conjunction with the incandescent mantle. He next alluded to acetylene. This brought to a close this most interesting series of lectures, for which Professor Lewes was accorded a very hearty vote of thanks.

A COMBINED CHARGING AND DRAWING MACHINE.

Remarkable Figures as to Labour in Machine Working.

It is with very considerable pleasure that it falls to our lot this week to turn the attention of the gas engineering world to what is a distinct advance in the application of the method of power drawing and charging machinery to the retort-house. It is one of those steps forward in the subordination of the processes of carbonization to mechanical control which is in direct line with the days when Mr. John West produced his first manual charger. But at the same time it is an advance that, now it is perfected and an actuality, excites a little surprise that the same thing has not been practically demonstrated before. It is, in short, an outcome of the demand for power machinery suitable for the class of works, having (say) anything from eight to fifteen or sixteen beds of retorts. It was given into the hands of Mr. John West to commence the revolution and cheapening of the world's retort-house practice by the application of machinery; and it has been left to him to make this, the latest improvement, which brings a larger number of works within the pale of (may it be written ?) the utmost economy in the matter of retort-house labour. What the upward limits in capability are of the compressed-air drawing and charging machines as they are well known in their separate form, and with their separate operatives and attendants for the opening and closing (as the case may be) of the retort-lids, are as yet unknown. Already 30 beds of tens have been comfortably reached by them; and each added unit reduces the average cost per ton of coal carbonized. But with these divided drawers and chargers, the limitation in respect of labour is well known. With them, the direction in which yet greater economy can be achieved is in the lessening of the spare time of the men by the addition of retort-beds to be dealt with by them and the machines. But this extension into higher regions of efficiency with this type of machine is only possible in large works.

However, how to make the compressed-air retort drawing and charging machines as developed by Mr. John West more



West's New Combined Charging and Drawing Machine.

applicable than hitherto (with economy) to medium-sized works is a problem that has often been forced upon that gentleman's attention; and even that doughty inventor and clever mechanician has found the problem encompassed by many difficulties. The direction in which he saw he must operate to attain success was in that of the lessening of the number of men required in connection with the separate drawing and charging machines, and in occupying the reduced number of men to, in comparison with the old system of working, a greater extent, in order to save a part of the waste time that is imposed by existing conditions. Working with this end in view, he also recognized that there was only one way of accomplishing his object, and that was by a combination in one machine of the two operations of drawing and charging, so that both orders of work might be brought under the immediate control of one operative, with an assistant for opening and closing the retort mouthpieces. Then, again, the idea of the combination of the two operations produced its mechanical complications and difficulties; and, moreover, it was, for more than one reason, imperative that combination should not produce unwieldiness. How well, after much labour and experiment, Mr. West has circumvented the many difficulties, and has developed a good, workable combination power drawing and charging machine, the operation of which can be easily performed by one man, can be borne witness to by those who were privileged to see the first completed example of the machine at the West Gas Improvement Company's works at Miles Platting, Manchester, last Wednesday. A large number of gas engineers were present that day; and they evinced considerable avidity in seeking for all information obtainable as to the construction of the machine, and in watching its operation. The one that was subjected to their critical examination that day has been purchased by the Wellingborough Gas Company, on the recommendation of their Engineer (Mr. J. T. Lewis), for their new works; and so —we may place it in black and white to prevent any disagreement on this question of fact in the future—the honour of being the first to adopt the new combined machine is theirs.

Before giving a statement that Mr. West made to his visitors on Wednesday regarding the machine and its promising capability for meeting the wants of a field of retort-house working lying between the small and the large retort-house, we may describe generally the construction of the machine. It consists of a framework carried on four travelling wheels, and, as will have already

been gathered, it is propelled along the retort-house, and from retort to retort, by a compressed-air driven motor. The machine is divided into two portions—one-half containing the machinery for charging the retorts with coal, and one-half that for drawing the coke. One attendant is sufficient for directing the whole of the operations of both drawing and charging, for which purpose he stands on a platform placed in a convenient position for attending to the levers connected to the motors and gear which perform the various operations required—the drawing portion of the machine being on his left-hand side, and the charging part on his right. All the levers are simple, and well under control. The machine is provided with a coal-hopper, and this hopper is furnished with feeding gear for delivering the charge of coal regularly to a scoop carried by a carriage, which is supported and travels along the frame forming a track for the charger carriage, and suspended from the coal-hopper. The hopper, together with the scoop, is adjusted vertically to the several tiers of retorts by a compressed-air driven motor and gear.

The scoop is driven into the retort twice in order to deliver its charge of coal—at first, delivering the coal to one side of the retort, and then to the opposite side. The quantity of coal per charge is regulated, by the size of the scoop, to suit the size of the retort; and the scoop does not rest on the retorts when entering and delivering the charge. The mechanism for driving the scoop into the retort consists of an air cylinder motor and gear fixed on one side of the scoop-carriage supporting-frame and track; chains being fixed at one end of the scoop carriage, and led over pulleys to a chain-drum, to which a forward-and-backward motion is given by a rack-and-pinion. Automatic gear is provided in connection with this gear for reversing the direction of the travel of the scoop carriage, and reversing the scoop both when in and out of the retort.

The drawing portion of the machine consists of a rake-bar, having a rake-head supported by a double channel frame forming a track for the rake-bar, which is driven into the retort over the coke, and withdrawn with the rake-head depressed into the coke, bringing the coke out with it. The rake-bar and frame are adjusted to the several tiers of retorts by gear connected with the same gear for adjusting the coal hopper and scoop; so that the operation of setting the machine in respect of both drawing and charging to the line of retorts to be operated upon is accomplished simultaneously. The rake is driven into the retort by chains leading and fixed to a chain drum or barrel, to which a forward and backward motion is given by a rack-and-pinion driven by a cylinder motor. The rake is under the control of the attendant by means of a hand lever and rocking gear placed in a suitable position.

The compressed air for driving the machine is generated by an air-compressor, which may be placed near, or at some distance from, the retort-house; the air being conducted to the retort-house by a pipe carried along one side of the house, and from which, at suitable distances apart, a flexible pipe is suspended. At the end of the pipe, an instantaneous coupling is provided for connecting up to the machine.

One important object gained by this combined machine is that the cost of installation is reduced by a smaller air-compressing plant than that required for separate machines; and naturally, the drawing-machine being combined with the charging-machine, it is carried on the one base—obviating the additional travelling and supporting wheels, motor, and gear for propelling the drawing-machine or hoisting the rake to the several tiers of retorts. It might have been possible to manufacture a cheaper machine, and to have utilized one motor for the whole of the mechanisms, which might have been put in and out of gear by clutches; but the experience gained with the separate machines as to the advantage derived by separate motors and gear for the purpose of driving the charger, travelling the machine, and hoisting the charger and rake, and also for the drawing-machine, is so conclusive—simplifying, among other good points, the operations of the attendant—that these features have been retained in the new combined machine, which it is convenient, though almost unnecessary, here to say, embodies all the improvements that Mr. West has from time to time introduced into the separate machines.

It may be of importance, and a matter of interest, to some of our readers to know the dimensions of the new combined drawing and charging machine; so as to see what saving is effected in regard to space occupied as compared with the separate machines. The total width of the machine is 13 feet; and its height 13 ft. 6 in. When the machine is at the end of the retort-house, with the charging portion nearest the wall, the space required for both charging and drawing the retorts is 12 feet from the inside face of the end wall of the retort-house to the centre of the end retort. When the machine is at the end of the retort-house with the drawing portion nearest the wall, the space required for both charging and drawing the retorts is 8 feet from the inside face of the end wall.

Therefore, as will have been seen, it is in capital expenditure and labour required, in comparison with the separate form of machines, for certain sized works, that advance has been made; and, although we have left the proof for Mr. West in a little speech and a number of tables which follow this description, it will be remarked that the new machine also shows an advantage in respect of the quantity of coal carbonized per man.

The engineers who inspected the machine last Wednesday were—we think we may speak of them collectively—highly pleased with the ingenious way in which Mr. West has overcome the many difficulties which faced him in attacking the problem of reducing the labour required in connection with stoking machinery of the size needed for meeting the conditions for which this new machine is specially designed. It goes without saying, too, that, Mr. West being the inventor of the combination, the strength of the machine is a matter upon which he will not hereafter fear reproach; and, in regard to smoothness of operation, it compares equally with the firm's other productions in the same line. When the reduction of labour which the new machine will represent in the case of medium sized works is calculated out to pounds per annum, we think it is safe to say that the saving effected will, after meeting interest, maintenance, and any other charges, leave a margin which will deserve the gas engineer's respect.

The Question of Labour—Mr. West Expounds Some Tabular Statements.

After the inspection of the machine and its operation, Mr. John West addressed his visitors—the operating platform of the new machine making an appropriate rostrum. He remarked that all present knew very well that his first efforts in connection with stoking machinery were with the manual type. The manual machinery had done very good work; and it was in a large number of very important works. Some of his friends would say that nothing had been brought out yet to beat it; and there was no doubt that the machines were doing excellent and economical work. But there were some engineers who thought they must have power for everything. He had no objection. However, after the manual machine, in catering for the larger works, he had to make several types of power machines—the wire-rope, steam, and compressed air. Finally, the compressed-air machines turned out to be the best; and that was the type he was now recommending for large works. Now as to the capability of the machines, they at first anticipated that twenty beds would be quite as much as they could do with a power machine. An installation made for the South Metropolitan Gas Company was originally intended for fifteen beds of tens; but the work for one pair of machines was gradually increased there until they eventually operated thirty beds of tens, and this is now the standard work. Machines were also being made so as to take in larger charges than engineers, as a rule, put in in England; so that he did not know how far the separate machines were going at the present time. He did, however, know this, that, with thirty beds of tens, employment sufficient for eight hours was not found for the men—the men were really only working five or six hours. In some cases, in the big works, the men were only working about five hours; and they were drawing 80 to 90 odd retorts regularly and systematically per hour. If the engineers of these works had operated satisfactorily on thirty beds, they knew they would find more employment for the men if they put on thirty-five beds; and there was no reason why they should give the men such a small amount of work, nor why the men should have so much idle time. Even in iron-works, they kept the men, with eight-hour work, working nearly the whole eight hours. So the question was how far they could go with the power machines. He did not know; but they had got to go beyond the thirty beds. But engineers in England had said (and over in America he also frequently heard the remark): "This is all right for large works, but what about moderate sized works?" Well, he wanted that day to upset a little the idea that power-stoking machinery was not suitable for medium sized works. He had a gentleman present who had been working twelve beds with the separate drawing and charging machines—the very same machines that were working on the thirty beds; and he had been working these twelve beds successfully and economically, and very few could beat him even on a larger scale. In fact, he was working the machines on twelve beds as economically as those engineers were who were working them on thirty beds. In some tables that he (Mr. West) had prepared, making certain comparisons between the separate and combined charging machines, the first example referred to Mr. Simmonds's working at Bury.* There he was working twelve beds with the large power machines—two separate machines. When working eight beds (in the summer he ran down to four beds, and the cost was little more), he only had two men per shift, and each man carbonized 7 tons 9 cwt. of coal. He (Mr. West) had not gone into the question of cost per ton; for wages varied so much he dared not touch that point. But from the tables engineers would be able to make their own comparisons on that point. Well, the figures referred to were when Mr. Simmonds was on six-hour work, and 3½ cwt. charges.

He believed Mr. Simmonds could tell them he was doing fully the weight per man shown, and a little more. But he (Mr. West) wanted to put the minimum in the tables. Now with five-hour charges, with (as in the first example) retorts 22 in. by 16 in., he was doing 8 tons 13 cwt. per man. Example No. 2 was with oval retorts 20 in. by 17 in.; and he (Mr. West) had never charged retorts like them before. The results were from working that he had lately carried out himself on the Continent at the works of the Municipality of Copenhagen. In these experiments, he charged the retorts with 400 lbs. of coal—Danish pounds, which were larger than English pounds. The number of men on the work would be seen; and the amount of coal they could deal with was 12 tons 17 cwt. Then in the third example, with retorts 22 in. by

* See also "Journal," Nov. 26, 1901, p. 1388.

SEPARATE CHARGING AND DRAWING MACHINES.*

EXAMPLE 1.—*Particulars of Working Separate Charging and Drawing Machines.*

Eight 22 in. by 16 in. Retorts per Bed—Eight-Hour Shifts. Six-Hour Charges.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight per Charge.	Weight per 24 Hours.		Weight per Man.	
						Tons	Cwt.	Tons	Cwt.
8	64	2	6	6 hours	3½ cwt.	41	16	**7**	**9**
12	96	3	9	6 hours	3½ cwt.	67	9	**7**	**9**

Five Charges per 24 Hours.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.		Weight per Charge.	Weight per 24 Hours.		Weight per Man.	
				Hrs.	Min.		Tons	Cwt.	Tons	Cwt.
8	64	2	6	4	48	3¾ cwt.	52	0	**8**	**13**
12	96	3	9	4	48	3¾ cwt.	78	0	**8**	**13**

EXAMPLE 2.—*Particulars of Working Separate Charging and Drawing Machines.*

Nine 20 in. by 17 in. Oval Retorts per Bed—Twelve-Hour Shifts. Six-Hour Charges.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight per Charge.	Weight per 24 Hours.		Weight per Man per Shift.	
						Tons	Cwt.	Tons	Cwt.
8	72	2	4	6 hours	400 lbs.	51	8½	**12**	**17**
16	144	4	8	6 hours	400 lbs.	102	17	**12**	**17**

Five Charges per 24 Hours.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.		Weight per Charge.	Weight per 24 Hours.		Weight per Man per Shift.	
				Hrs.	Min.		Tons	Cwt.	Tons	Cwt.
8	72	2	4	4	48	3¾ cwt.	58	10	**14**	**12½**
16	144	4	8	4	48	3¾ cwt.	117	0	**14**	**12½**

EXAMPLE 3.—*Particulars of Working Separate Charging and Drawing Machines, on Thirty Settings of Ten Retorts.*

22 in. by 16 in., or 300 Mouthpieces—Eight-Hour Shifts. Six-Hour Charges.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight of Charge.	Weight per 24 Hours.	Weight per Man per Shift.	
							Tons.	Cwt.
30	300	4	12	6 hours	3½ cwt.	210 tons.	**17**	**10**

EXAMPLE 4.—*Particulars of Working Separate Charging and Drawing Machines, on Thirty Settings of Ten Retorts.*

22 in. by 15 in., or 300 Mouthpieces—Twelve-Hour Shifts. Six-Hour Charges.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight per Charge.	Weight per 24 Hours.	Weight per Man per Shift.
							Tons.
30	300	4	8	6 hours.	3½ cwt.	210 tons	**26¼**

16 in., and eight-hour shifts, the table would answer for places where they had thirty beds working; and each man carbonized 17 tons 6 cwt. He had taken simply and purely the men who were working the machinery, so that gas engineers could compare this with any other systems of working where they were only taking the men that were actually on the work of drawing and charging. He had not taken pipe-jumpers or men attending to furnaces below the stage, but merely those who had anything to do with the machine work. However, the figures he had just given were for six-hour work; but he knew of a case where they were putting in more than 3½ cwt. charges, and were doing as much as 20 tons per man on the eight-hour shift. In the fourth example, they had the figures as to what was being done on twelve-hour shifts; and the weight per man was 26¼ tons. Now he thought these examples would show them that the power machinery (drawing and charging separately) was being operated most economically in three different cases—a small works, a medium sized works, and a large works. The drawing, charging, and coke conveying at Bury was being done at 1s. 1½d. per ton; and this sum included the whole of the labour for bringing the coal into the coal-store and retort-house, the machine men and attendants, furnace men, and storing the coke in the yard. And this was the smallest installation referred to. These were all living examples; and the figures included lid openers and closers. He thought they showed that machinery had been worked as economically as—in fact, more economically and more efficiently than—any other system. Well, this led him to his combined machine; and the point he wanted to show was, if he could get one man to do the two operations of drawing and charging, then he would reduce the labour for medium-sized works. With the separate machines, the drawing and charging were being performed at the rate of 80 or 90 retorts per hour. For many years past, he had been anxious to reduce the cost of the machinery and the number of men; and for some years he had been struggling to do this. The combined machine was the result. By combining the two machines together, the two operations are accomplished by one man. There was no use in having two machines in a house where there were only twelve or fourteen beds for a man to get through. With the separate power machines at Bury, Mr. Simmonds was working with three men, and when they got to sixteen beds, as at Copenhagen, it would be seen that they only had four men. In the case of Copenhagen, he (Mr. West) was working six-hour charges and twelve-hour shifts, the drawing and charging taking place every two hours, the actual work during this time occupying about one hour of the man's time, although they had only been working the machinery one month; therefore they had about six hours' rest out of twelve. Now in connection with this combined machine, they had made some calculations from experiments with the machine before them; and forty retorts per hour, doing both operations, could be taken as an average with the machine. He believed fifty could be done. However, in Example 1, with the combined machine, he showed how much coal each man would do working six-hour charges—two men to each machine, one of them opening and closing the lids. He would not go into the figures; but would leave them for those interested to further investigate them. Now with the six-hour charges, the men would get, taking the first set of figures given, about three hours' rest out of an eight-hour shift. In connection with the five charges per twenty-four hours, the results in the tables were taken out on the same basis. Upon Example 2, there was no necessity to comment. The combined machine

* Figures from actual working results.

NEW COMBINED CHARGING AND DRAWING MACHINE.

EXAMPLE 1.—*Particulars of Working the Combined Charging and Drawing Machine on Eight-Hour Shifts—i.e., One Man on Machine, and One Man Opening and Closing Lids.*

Six-Hour Charges.

No. of Beds	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight per Charge.	Weight per 24 Hours.		Weight per Man per Shift.	
						Tons	Cwt.	Tons	Cwt.
10	80	2	6	6 hours.	400 lbs.	57	2	**9**	**10**
12	96	2	6	6 hours.	400 lbs.	68	11	**11**	**8**
15	120	2	6	6 hours.	400 lbs.	85	13	**14**	**5**

Six Charges per 24 Hours.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.		Weight per Charge.	Weight per 24 Hours.		Weigh per Man per Shift.	
				Hrs.	Mins.		Tons	Cwt.	Tons	Cwt.
10	80	2	6	4	48	3¾ cwt.	65	0	**10**	**16½**
12	96	2	6	4	48	3¾ cwt.	78	0	**13**	**0**
15	120	2	6	4	48	3¾ cwt.	97	10	**16**	**5**

EXAMPLE 2.—*Particulars of Working the Combined Charging and Drawing Machine on Twelve-Hour Shifts—i.e., One Man on Machine, and One Man Opening and Closing Lids.*

Six-Hour Charges.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.	Weight per Charge.	Weight per 24 Hours.		Weigh per Man per Shift.	
						Tons	Cwt.	Tons	Cwt.
10	80	2	4	6 hours	400 lbs.	57	2	**14**	**5**
12	96	2	4	6 hours	400 lbs.	68	11	**17**	**2**
15	120	2	4	6 hours	400 lbs.	85	13	**21**	**8**

Five Charges per 24 Hours.

No. of Beds.	No. of Mouth-pieces.	Men per Shift.	Men per 24 Hours.	Duration of Charge.		Weight per Charge.	Weight per 24 Hours.		Weigh per Man per Shift.	
				Hrs.	Mins.		Tons	Cwt	Tons	Cwt.
10	80	2	4	4	48	3¾ cwt.	65	0	**16**	**5**
12	96	2	4	4	48	3¾ cwt.	78	0	**19**	**10**
15	120	2	4	4	48	3¾ cwt.	97	10	**24**	**7½**

which they had been inspecting was for the Wellingborough Gas Company; and it was set for doing 400-lb. charges. If Mr. Lewis wanted to do five-hour work, all he would have to do would be to reduce his charges a little. He (Mr. West) had undertaken to work the machine on five-hour work and fourteen beds at Wellingborough. However, the figures were all in the tables—the number of men, the weight of the charges, and the tonnage of coal each man could do; and so the cost per ton of the combined machine could be worked out for any district.

To Mr. R. O. Paterson fell the pleasant duty of thanking Mr. West for the privilege afforded the visitors in inspecting the operations of the combined form of machine. All gas engineers, he said, looked upon Mr. West not so much as a manufacturer as a gas man. He (Mr. Paterson) had a lively recollection of meeting him in Maidstone at the time he was making his rudimentary experiments with his manual machine, and those of them who had been acquainted with him since those early days must feel proud of him on account of the development he had brought about in the matter of stoking machinery. More credit was due in this respect to Mr. West than to any man—in fact, they must look upon him as the pioneer of successful stoking machinery. Those assembled round him that day would like to wish him continued success in his undertaking. He (Mr. Paterson) had been a user of the manual machines for something like nineteen or twenty years; and he had been gratified with the operation of them from the first. He could not help thinking, as a somewhat conservative man, that the old manual machine would take a good deal of beating even now. In many of the points, it would hold its own against power stoking. But he was not going to disparage the further developments they had seen that day. It was, to his mind, perhaps more a question of labour than of efficiency of carbonization. The matter of gas-works labour was the moving topic of to-day. From that point of view, this machine would undoubtedly carry the palm over manual machine stoking. But, on the other point of efficiency of carbonization, he was convinced that the machine never would excel the efficiency of the other one. However, the question now was more that of dealing with the labour than the efficiency or perfection of carbonization. With these few remarks, he should like to thank Mr. West for the lesson he had given them upon the perfection of stoking machinery.

The thanks were endorsed by all present; and Mr. West, in a little acknowledgment, remarked that Mr. Paterson was always a candid speaker. He (Mr. West) would not debate the question of the efficiency of the manual machine, because he did not think it was debatable. As a machine for carbonization, he did not think it would be beaten. The question was now one of labour; and his endeavour had been to make a combined machine which would work as efficiently as a manual machine, but would supersede it in regard to labour in moderate sized works. He thanked those present very heartily for their appreciation.

Some Miscellaneous Notes.

In walking round the West Gas Improvement Company's works, many points of considerable interest came to the notice of the engineering visitors. It was observed that, in recent years, the Company have largely supplemented their machine equipment by the most modern and approved plant—producing in their results greater expedition and consequently reduction of cost, with additional refinement in the finish of the output. Not only have new machines of English design been adopted, but American invention has been drawn upon as well. The character of the work in progress reflects the trend of gas-works improvement and expansion, in the adoption of plant enhancing economy and reducing manual labour. Among the work, three pairs of compressed-air charging and drawing machines were seen approaching completion—two pairs being for the Municipal Gas-Works of Copenhagen; and other machines are in progress. By the way—the inclined system notwithstanding—the requirements of engineers for the machine stoking of horizontal retorts show no sign of abatement; and, indeed, last year and the year before boast records in the number of the West stoking machines installed. A large double-lined air-compressor was also seen under test; this being destined to complete an installation at the Beckton works of the Gaslight and Coke Company. But the West Gas Improvement Company are in the happy position of being well supplied with work both in connection with horizontal and with inclined retort installations. Their coal breakers, elevators, coal hoppers, and coke-conveying machinery, and other special iron-work are as applicable to the one system as the other; and a goodly share of the work in these connections, quite irrespective of system, has fallen into their net. Speaking of elevators and conveyors, one of the former was observed in an advanced stage of construction for the Blackpool Corporation Gas-Works; parts of a conveyor and elevator for the Aalborg works of the Danish Gas Company were being busily pushed to the point of completion; and the trough of a coke-conveyor for the Gaythorn station of the Manchester Corporation was in a nearly finished condition. In all this work the reputation of West for substantiality and plenty of metal was being maintained. About the coke-conveying plant the Company are now constructing, we have something special to say in a little independent article elsewhere. Roof columns and girder work for the Enfield Gas-Works; the compressed-air riveting; the piles of conveyor and elevator chains completed and ready for delivery; the special power drilling and slotting tools; and three machines for dealing with mouthpieces—one for planing, one for shaping, and one for facing retort-lids—were among the multitudinous forms of work over which the visitors paused. Incidentally, it may be noted that the lid shaping and facing machines were specially designed and made by the firm; and their like we have never seen before. We will leave the works now; believing that what has been stated in this article will possess more than ordinary interest for our gas-engineering readers. Upon his new achievement, Mr. West and his Company are entitled to be warmly congratuated.

PHOTOMETRY FOR ELECTRICIANS—AND OTHERS

The Meeting of the Institution of Electrical Engineers on Thursday last was wholly given up—apart from a little private business—to the consideration of photometrical questions; and it was found necessary to adjourn their further discussion until Thursday evening next. The subject was a somewhat novel one, so far as the Institution was concerned; but its importance, and the high repute of the author of the paper which dealt with it, sufficed to gather together an audience which filled the large theatre of the Institution of Civil Engineers, where the meeting was held, almost to overflowing. The author, Dr. J. A. Fleming, M.A., F.R.S., Professor of Electrical Engineering in University College, London, did not read his paper, entitled "The Photometry of Electric Lamps," of which copies were in the hands of his audience, but delivered an address, in which he drew attention to its more important points, and referred to the items of an interesting collection of photometrical apparatus, and a number of diagrams. At the conclusion of Dr. Fleming's remarks, which gave an excellent epitome of the contents of his long and valuable paper, Mr. A. Vernon Harcourt, M.A., F.R.S., one of the Metropolitan Gas Referees, was called upon to open the discussion, and he was followed by Professor R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory, and Capt. Sir Wm. Abney, K.C.B., F.R.S. The meeting adjourned until next Thursday, after Mr. A. P. Trotter had undertaken to re-open the discussion on that evening, and to exhibit some photometrical apparatus of his own. The three distinguished scientists who spoke on Dr. Fleming's work last Thursday had no hostile criticism to offer; and perhaps no better testimony than this of the soundness of the work which he described could be given him. It only remains, therefore, to congratulate him on his able contribution to photometrical literature, and to give, in the sequel, a digest of his paper, and a few notes on the discussion so far as it has already taken place.

After referring to the fact that, in the course of twenty years, only one paper dealing with photometry had been brought before the Institution of Electrical Engineers, and that one as long ago as 1893 ("On a New Form of Portable Photometer," by Sir David Salomons), Dr. Fleming related a recent experience illustrating the great differences in photometrical results obtained by competent observers at the present time in the examination of ordinary incandescent electric lamps. The important alterations in official methods of gas photometry introduced by the Metropolitan Gas Referees a few years since afforded an additional argument for a revision of the prevalent uncertain methods of electric lamp photometry. The subject naturally divided itself into the consideration of: (1) Standards; (2) processes of measurements; (3) special considerations affecting heterochromatic photometry; (4) international agreements on the subject of standards of light and processes of testing.

Dealing first with the standards, Dr. Fleming said that, in view of the abolition of the sperm candle in favour of a pentane lamp by the Metropolitan Gas Referees, it was likely that in a short time the use of the sperm candle in gas testing would entirely cease, and breath might be spared in abusing the nominal legal standard of the Gas Acts. Abroad, also, the candle, as such, was being displaced by other standards of light. The standards now in use might be divided into: (1) Flame standards, and (2) incandescence standards; and furthermore they might also be divided into: (1) primary or reference standards, and (2) secondary or working standards. The flame standards which had been exhaustively investigated up to the present were:

(*a*) The colza oil or carcel standard, which remains the official standard for gas-testing in France, and still preserves the form given to it by Dumas and Regnault.

(*b*) The various pentane lamps of Mr. A. G. Vernon Harcourt, F.R.S., well known and much used in Great Britain, one of which is now the official standard for London gas-testing.

(*c*) The amyl-acetate lamp of Herr von Hefner-Alteneck, introduced in 1884, and extensively employed in Germany, where it is the legal standard.

Other flame standards, of which half-a-dozen, including the Methven slot, were named, had been suggested and more or less used. It was, however, generally agreed that a flame standard must comply with three conditions—

1.—The combustible must be of constant and definite chemical composition, easily obtained pure, and tested for purity without difficulty.

2.—It must be burnt under simple and easily controlled conditions.
3.—Unavoidable changes in atmospheric pressure and composition must not sensibly affect the character of the flame.

Moreover, it should be capable of being set up anywhere and be self-contained. This last condition ruled out any coal-gas standard, even if experience had not shown that the Methven screen by no means rendered the light emitted by a coal-gas flame independent of the composition of the gas.

The three flame standards at present holding the field were:

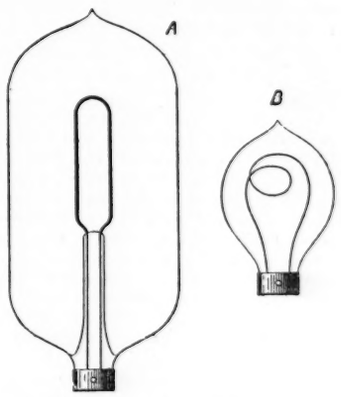
1.—The 1-candle pentane reference standard, introduced by Mr. A. G. Vernon Harcourt in 1877.
2.—The more recent 10-candle pentane lamp by the same inventor, now adopted as the official working standard by the Gas Referees, brought out in 1898.
3.—The amyl-acetate lamp, introduced by Herr von Hefner-Alteneck in 1884.

Dr. Fleming, after a fitting tribute to Mr. Harcourt's thirty years' work on photometry, gave a full description of his 10-candle pentane lamp, now the standard in the Metropolitan gas-testing places, and his original 1-candle standard pentane flame. Liebenthal's investigations on the effect of changes in barometric height and the hygrometric state of the atmosphere on the pentane 1-candle wick lamp were also referred to. Dr. Fleming said he quite hoped that similar investigations would be made on the official 10-candle Harcourt standard, which, so far as he knew, had not yet been examined in this way. Later, however, Dr. Fleming stated that the light of this 10-candle lamp was affected by the presence of water vapour and carbon dioxide in the air. The third flame standard was the Hefner lamp, which had come into very general use, especially in Germany—"no doubt on account of its German origin." The most probable value of the Hefner lamp flame (or Hefner unit) was 0·88 English standard sperm candle. The chief objection that (in countries other than Germany) had always been raised to the use of the Hefner lamp as a standard, was the reddish character of the light. Certainly, in this respect it compared very unfavourably with the Harcourt 10-candle pentane lamp, the light of which was comparable in quality with that of a glow-lamp working at about 3 watts per candle-power. In other words, the pentane flame was at a temperature nearer to that of the glow-lamp filament when in use. The employment of the Hefner lamp as a means of standardizing glow-lamps when used at the ordinary efficiencies, gave rise to the difficulties of heterochromatic photometry, to which allusion would be made later. Its use in arc-lamp photometry was out of the question. The necessity for corrections being applied to results obtained with the use of the Hefner standard to compensate for divergencies from the normal atmospheric conditions was dwelt upon, and the formulæ for making corrections deduced from Liebenthal's researches were quoted.

Dr. Fleming then passed on to the consideration of the incandescence standards, of which the practical ones all employed either platinum or carbon at a high temperature. Violle's platinum standard had been lightly adopted by various Congresses as an international standard of light; but attempts to reproduce it had failed more or less signally. The most successful reproduction of the Violle standard had been carried out by Mr. J. E. Petavel in the Davy-Faraday Laboratory in 1899; and he showed that, given certain elaborate precautions, it was trustworthy within 1 per cent. It was, however, of such a nature that it was unlikely to be set up anywhere in this country except at the National Physical Laboratory. Attempts to produce a secondary or working incandescent platinum standard had not been very successful, although the one devised by Lummer and Kurlbaum was used as a reference standard at the Reichsanstalt at Charlottenburg.

Dr. Fleming said that the difficulties which were inherent to flame standards, owing to variations in the pressure, humidity, and degree of vitiation of the atmosphere, had drawn his attention to the great advantages which an electric glow lamp should possess as a standard of luminous intensity. The use of an ordinary carbon filament lamp for such a purpose was, however, out of the question, because of the falling off in intensity which occurred. There were three reasons why the light-giving power of a carbon filament lamp used at constant voltage altered—viz., owing to: (1) Changes in electric resistance of the filament. (2) Changes in the nature of the surface of the filament. (3) Deposit of carbon upon the interior of the bulb.

It was well-known that most glow lamps showed an increase in candle power during the first few hours of use, owing to decrease in the resistance of the filament; but if a good filament were run in a lamp at normal, or slightly higher, voltage for fifty hours or so, it reached a condition in which a small further use did not appreciably alter it. The glass bulb would, however, have become somewhat blackened; and Dr. Fleming therefore had set about devising a means by which the effect of this blackening could be nullified, and finally had decided on the plan of "aging" the filament, by fifty hours' use in one bulb and then removing it from that bulb to a new clean one of special form and large dimensions. The blackening of a bulb appeared to arise from the projection of carbon from the filament, and hence proceeded most rapidly in small bulbs in which the carbon particles could readily reach the glass bulb. But on mounting an "aged" filament in a large bulb, the radius of which was much greater than the mean free path of the molecules at the pressure of the residual air, the chances of a molecule of carbon reaching the glass were much reduced. Acting on these lines, Dr. Fleming obtained from the Edison and Swan Electric Light Factory, about six years ago, a number of 16-candle power "aged" filaments of simple horseshoe shape, mounted in large clear glass bulbs, 6 or 8 inches in diameter. These were checked in 1896 by comparison with the Harcourt air-gas 1-candle flame. The working voltage of the lamps was carefully measured by means of a potentiometer and a Clark cell; and the candle power, voltage, and current were recorded on each lamp. The candle power was observed in a horizontal direction, and perpendicular to the plane of the filament when the axis of the filament was vertical. A certain number of the lamps were set aside as primary or reference standards, for occasional employment in verifying the candle power of others; and the remainder were brought into use as working or secondary standards. The illustration shows (A) one of these standard glow lamps, and, for comparison, (B) an ordinary 16-candle power glow lamp.



A.—Fleming-Ediswan Standard Glow Lamp.
B.—Ordinary Ediswan 16-Candle Power Glow Lamp.

A number of these standard glow lamps, which had been standardized in 1896, were compared again in March this year with the Harcourt 1-candle air-gas flame. The results, when the latter standard was not depreciated by the effects of bad ventilation, were as follows:—

Mark on Standard Glow Lamp.	Mean Candle Power of Glow Lamp by Air-Gas Standard.	
	In 1896.	In 1902.
Pender I.	14·25	14·22
,, II.	16·40	16·40
,, III.	12·75	12·75
,, IV.	14·50	14·00
,, V.	15·55	15·40
,, VI.	11·50	11·75

The "working volts on the lamp" was 96 in all cases. The apparent falling off in the candle power in the six years in the case of the lamp marked "Pender IV.," ought not to be wholly attributed to changes in it, as its value was only taken by two observers in 1896, instead of by three, as with the other lamps. With this exception, there was no difference greater than 2 per cent. in the values observed in 1896 and 1902; and some of this difference must be ascribed to the air-gas standard, as the latter was found to be very greatly affected when the ventilation of the photometer-room was bad. In fact, a series of comparisons made when the air of the room was clearly vitiated, showed that the illuminating power of the 1-candle air-gas flame was thereby depreciated by 8 to 10 per cent.

A suggested incandescence standard of light was the light from 1 square millimetre of the crater of an electric arc lamp; but it had been found to have widely different values (170, 158, and 147 candles) by Trotter, Blondel, and Petavel, and was objectionable in respect of the quality of the light.

Dr. Fleming said that, from the considerations outlined above, he had come to the conclusion that there were five sources of light which could probably be regarded as sufficiently constant to enable them to be used for reproducing a standard of luminous intensity with a degree of accuracy approximating to 1 per cent. or less. They might be classified as follows, viz:—

As primary standards—
1.—The Violle platinum incandescent standard.
2.—The Vernon-Harcourt pentane 1-candle flame standard.
As practical working standards—
3.—The Hefner or amyl-acetate lamp.
4.—The Vernon-Harcourt self-contained 10-candle pentane lamp.
5.—The Fleming-Ediswan large bulb incandescence electric lamps.

The first two reference standards could be set up at a National standardizing laboratory or a Government testing laboratory, and could be relied upon to preserve a selected standard or unit of light with an accuracy which was comparable with that of photometric measurements generally. Of the three working standards, the amyl-acetate lamp was decidedly inferior to the other two in the quality of its light, and difficulties arose in using it even to standardize glow lamps; while it was quite unsuitable for use with arc lamps. Moreover, experience showed that a 1-candle standard was not so generally useful as a 10-candle.

Passing on to the second division of his subject—viz., the consideration of photometric processes—Dr. Fleming described the Lummer-Brodhun device, and a modification of it which he had made for use in the testing of arc lamps. He then remarked that photometers might be divided into three principal classes, as follows:—

(*a*) Intensity photometers, by means of which a comparison was made between the luminous intensity of two sources of light.

(*b*) Illumination photometers, by means of which the illumination in any locality in candle-feet or some similar units was measured.

(*c*) Spectrophotometers, in which selected rays from the spectra of two lights were compared in respect of luminous intensity.

The first class of intensity photometers was that with which the paper primarily dealt; and it might be subdivided according to the method adopted for making the observations. Thus, intensity photometers might operate by—

(*a*) Equalizing the illumination of two portions of a semi-transparent or opaque screen formed of paper, porcelain, or ground glass, the one portion illuminated by one light and the other by a standard; the equalization being effected by moving the sources of light to various distances. Examples: Bouguer, Foucault, Harcourt, and Ritchie.

(*b*) Equalizing the two shadows of a rod made by two lights moving to different distances with or without optical dispersion of one light by a lens. Examples: Lambert, commonly called the Rumford, Abney, Ayrton, and Perry.

(*c*) Equalizing the illumination all over a screen, one portion of which is semi-transparent and the rest opaque. Examples: Bunsen (grease spot), Leeson, and Dibdin (star disc).

(*d*) Equalizing the illumination of two white surfaces inclined at equal or unequal angles, and placed in line between the lights to be compared. Examples: Ritchie, Bunsen and Roscoe, Trotter, Thompson, and Starling.

(*e*) Equalizing the illumination of two portions of the field of view of a telescope by bringing light from two sources to each part separately by total reflection in prisms. Examples: Swan, Lummer-Brodhun, Weber, Krüss, and Fleming.

(*f*) Equalizing two fields of light by weakening one by means of crossed polarizing prisms. Examples: Arago, Zollner, Wild, Salomons, Pickering, and Nichols.

(*g*) Equalizing the illumination on two portions of a white surface by weakening one of the illuminations by interposing a rotating disc and having a sector cut out of it which can be varied in magnitude. Examples: Fox-Talbot, Napoli, Guthrie, and Abney.

(*h*) Equalizing two fields of illumination by the interposition of an absorbing wedge. Examples: Pritchard, Sabine, and others.

Of late years, photometry had been for the most part conducted by means of the bunsen grease-spot disc, or modifications thereof, though the Gas Referees had recently adopted a modified form of the Foucault photometer. An ordinary gelatine photographic plate taken from a packet of unexposed negative plates formed a good substitute for the translucent paper used by the Gas Referees. For electric glow lamp photometry, however, Dr. Fleming had found no photometer superior on the whole to the contrast form of the Lummer-Brodhun photometer, which, when skilfully used, enabled a difference of less than $\frac{1}{2}$ per cent. in the luminous intensity of the two lights to be determined.

The construction of the photometer bench or table, and proper ventilation of the testing room, were very important, especially when a flame standard was used. The arrangement of bar photometer adopted by Dr. Fleming for testing glow lamps against a standard glow lamp, of the pattern already described, was shown. In order to eliminate the variation in candle power of a glow lamp in different directions, he recommended taking, in any case, the maximum and minimum horizontal candle power, and the candle power in the direction of the axis of the lamp. The last value was usually the most important, because the larger number of glow lamps were hung head downwards.

Dr. Fleming next discussed a method, which he had found to answer very well, for determining the form of the polar curve of luminous intensity of electric arc lamps; and he showed how, from that curve, the illumination produced on a roadway by any number of such arc lamps placed at any distances and at any heights could be determined. It thus became possible to decide exactly on the proper heights and distances of the lamps to obtain a given result. The third division of his subject—viz., "Heterochromatic Photometry"—was exhaustively treated next by Dr. Fleming; but as it is of less direct interest to most readers of the "JOURNAL," we do not propose to pursue his treatment of it in the present article.

Passing on to the fourth and last division—viz., "Photometric Units"—Dr. Fleming quoted the nomenclature adopted by the Congress of Electricians at Geneva in 1896. In speaking of this, and definitions adopted by earlier congresses, he made the following cogent observation:—

> The resolutions of congresses are often carried at the instigation of one or more influential or persuasive speakers; but it is a matter of regret that we have not in these matters what the politicians call a *referendum* to the general body of electricians. No congress can force a term into use which does not commend itself to the mind of the ordinary worker. In this case, one cannot but wish that the resolutions adopted had been previously more discussed in the technical Press.

He then stated his opinion that the "candle" was too small a unit of luminous intensity for the purpose of electric lamp photometry, and proposed that "10 candles" should instead be adopted as the unit, and spoken of as "one lamp." Thus a light now described as of "10-candle power," would be called "one-lamp power." The unit of brightness or illumination would then be the "lamp-metre," instead of the "lux" of the Geneva Congress, which was really too small for practical purposes. It would be remembered that the unit of luminous intensity was defined by the Geneva Congress as one *bougie-decimale*, or Hefner unit, for which Dr. Fleming would substitute one-lamp or 10 English candles; while the Congress unit of illumination—viz. "the lumen," representing the light sent out from a unit source through a unit solid angle—would be correspondingly altered with Dr. Fleming's change in the unit of intensity. Similarly, the unit of illumination, or "lux" of the Geneva Congress, which represented a flux of one lumen per square metre, would be altered by Dr. Fleming to the "lamp-metre;" and he would similarly alter the other, less important, derived units of intrinsic brightness and quantity of light. He concluded by expressing a hope that a primary reference standard of light might actually be established in England, and that the National Physical Laboratory would without delay investigate afresh the Violle and other proposed standards. There was appended to the paper a comprehensive bibliography of the subject.

Mr. A. Vernon Harcourt, M.A., F.R.S., opened the discussion by congratulating the author on the exhaustive character of his paper, and then proceeded to relate experiences he had had in comparing lights of different colours in connection with investigations made for the Elder Brethren of the Trinity House, as to the relative penetrative powers of gas, oil, and electric lights in lighthouses in clear and foggy weather. By using the "star" type of disc, he had been able to make fairly accurate estimations of the intensity of electric arc lights by comparing the illumination of one side of the disc, when set up at distances of one, two, or three miles from the arc light, with the illumination of the other side of the disc by a one-candle pentane flame.

Professor R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory, said that that Institution was about to be equipped with a complete set of photometrical apparatus; so that the hope expressed by Dr. Fleming as to the investigation of certain photometrical questions was likely to be realized. It appeared from Liebenthal's investigations that the Hefner lamp was superior to the 1-candle pentane (wick) lamp, as it was less affected by fluctuations in atmospheric pressure. With regard to Petavel's work, he was sanguine of realizing the Violle unit; but it should be borne in mind that the use of an incandescent surface was only practicable if two conditions were fulfilled—viz.: (1) That it always radiated the same at a given temperature, and (2) that the temperature could be maintained constant during the period of use. Petavel had lately used iridium and other metals of the platinum group for the production of an incandescence standard with more satisfactory results than platinum itself. It was possible to ensure a definite temperature by separating the radiation from the source into two portions. At low temperatures, the radiation from the red end of the spectrum was greater; at high temperatures, that from the violet end was greater. At a certain temperature, the radiation from the two ends was equal; and this temperature was a perfectly definite one, which might be fixed accordingly for an incandescent body for use as a standard of light. Unfortunately, the approach to the point of equality was somewhat too rapid to admit of very great accuracy in fixing it. Petavel was engaged in further investigations of incandescence standards; and his results so far appeared to be very promising.

Captain Sir W. Abney, K.C.B., F.R.S., spoke on colour photometry at considerable length. He said that he was able, by the oscillation method, to match two so different colours as red and green with an error not exceeding 0·5 per cent. Incidentally, he put and answered the question: "What is white light?" He said that there was a physiological white light, corresponding to the light observed by a certain part of the retina, which made all colours equal. This light was very nearly that of the positive crater of the electric arc.

PERSONAL.

Mr. R. P. ELLERSHAW, who is at present with the High Wycombe Gas Company, has been appointed Manager of the Gas-Works at Ruthin. There were 89 applications for the post, which was advertised in the "JOURNAL" for the 18th ult.

His Majesty has been pleased to confer upon Sir BENJAMIN BAKER, K.C.M.G., the honour of a Knight Commander of the Bath, for his services in connection with the barrage works on the Nile which were opened last Wednesday by His Royal Highness the Duke of Connaught. The works have been carried out by the firm of which Sir John Aird, Bart., M.P., is the head.

The Directors of the Londonderry Gas Company have appointed Mr. HENRY R. M'CARTER to the secretaryship, rendered vacant by the death of Mr. J. Macnie, which was recently announced in our columns. The new Secretary has been for some time in the service; and his promotion is a recognition by the Directors of his ability, courtesy, and knowledge of the Company's business.

Mr. W. A. WATSON-ARMSTRONG has been appointed a Director of the Newcastle and Gateshead Water Company in place of the late Vice-Chairman (Mr. W. B. Wilkinson); and Mr. J. C. Hamilton, of Preston, succeeds Mr. Wilkinson as Vice-Chairman. Mr. Watson-Armstrong is a nephew of the late Lord Armstrong, a founder of the Company and for many years Chairman.

At the last meeting of the Gas and Electric Lighting Committee of the Leicester Corporation, Mr. DOUGLAS F. COLSON, son of the Engineer and Manager (Mr. Alfred Colson, M.Inst.C.E.), was promoted to the post at the Aylestone Road Gas and Electric Lighting Works till recently held by Mr. Laurie Trewby, who has been appointed Engineer and Manager of the North Middlesex Gas Company.

The friends in various parts of the country of Mr. THOMAS CASH, of Birmingham, will, we are sure, learn with regret that a few weeks ago he met with a serious accident which has confined him to his bed since the 29th ult. Unfortunately, this trouble came upon him just as he had recovered from an illness of three months' duration; so that he has been the unwilling medium for enforcing the truth of the proverb about misfortunes.

Mr. GEORGE GILCHRIST, Assistant-Manager of the Kirkintilloch Gas-Works, has been appointed Manager at Stewarton, Ayrshire, in succession to Mr. John Black, who has been selected for the position of Manager and Engineer to the Callao (Peru) Gas-Works, for which applications were recently invited in the "JOURNAL." Mr. Gilchrist was a pupil of Mr. T. Wilson, of Coatbridge, who entertains a high opinion of his ability to fill a good position in the gas industry.

Mr. JAMES GIBSON, who has relinquished the position of Engineer and Manager of the Beverley Gas-Works to take a similar position at Leigh, has just received various tokens of the esteem in which he is held in the town. At a gathering of members and officials of the Corporation, the Borough Treasurer (Mr. J. H. Hobson) presented him with an American roll-top desk, accompanied by appreciative references to his work at Beverley and the best wishes of the donors for his success in his new sphere of labour. He has also been presented by the workmen and friends with a solid silver tea and coffee service, and a silver-mounted tray, together with a silver water-jug for Mrs. Gibson. Pleasure was expressed by them at Mr. Gibson's promotion, and he was wished good health and long life. The members of the choir of the Congregational Church recently asked Mr. and Mrs. Gibson's acceptance of a *souvenir*, in token of their regard for them, and in appreciation of their services in the choir. It took the form of a pair of Carltonware vases and Crown Derby cup and saucer.

Carborundum for Coating and Repairing Gas-Retorts. — Until recently an opinion has generally prevailed that carborundum is fire-resisting only when allied with a homogeneous material which possesses this quality in an equal degree. But it has lately been shown that a product of lower fire-resistance, when coated with carborundum, answers all requirements. A process to effect this object has been devised by Dr. William Engels; and it is reported to be very successful. It consists in mixing carborundum with suitable binding material, and diluting the mixture with water, so that it can be easily applied like paint. Experiment has shown that the thickness of the coating need not be more than 0·5 millimetre, even for the highest temperatures used in firing; so that from 2 to 2½ lbs. of carborundum are required per square yard of surface. Bricks are coated by simply dipping them in the carborundum paste. The material can be usefully employed in gas-works as a protective coating for retorts, or for filling cracks; and it is claimed that its application on the inside will pevent the formation of clinker. It can be applied not only when the retorts are cold, but when they are thoroughly hot. In support of the last statement, we are informed that, in one of the largest gas-works in Germany, two retorts which showed large cracks were repaired, while red hot, with a mixture of carborundum and fire-clay diluted with a little water, in about three minutes. They were brought into use again immediately afterwards, and worked for three months without the mended portions causing the slightest trouble. For repairing and coating retorts while hot, a mixture of carborundum and fire-clay has to be employed; but when they are cold, water-glass is preferable to the latter.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

The Quarterly Meeting at Bradford.

As explained in the "JOURNAL" last Tuesday, we were unable owing to a failure in the postal service, to give a complete report of the proceedings at the above meeting, held on the previous Saturday. We nevertheless indicated the nature of the general business, and published the three papers submitted to the members; and we give below a report of the discussion upon those of Messrs. Brearley and Buckley (taken together)—Mr. Fowler's paper, on "Working with an Illumination Photometer," being held over.

The PRESIDENT (Mr. A. Graham, of Mansfield) said the members were very much indebted to the writers of these papers for bringing the subject of incandescent lighting before the meeting.

Mr. T. B. BALL (Rochdale) said he had learned from several sources lately that incandescent gas lighting was making its way in factories; and he thought there was plenty of opportunity for encouraging its use in that direction. It was not a matter in which he had very much experience. As the members would know, he was in the service of a Corporation; and, though they were charged now-a-days with indulging too much in municipal trading, they did not go in for gas-fittings or lighting up factories and other premises. At the same time, it was the duty of all to do what they could to encourage the use of the best method of lighting in factories or anywhere else. He was indebted to Mr. Brearley for the information he had given with regard to the woollen industry; for whatever was applicable to that trade, was also applicable to the cotton industry, and it was more especially from that point of view that he was interested in the paper. He had, of course, had experience of incandescent street lighting; but it would be needless to give his views on that subject to the meeting. He was very pleased to see it stated in the Manchester papers that morning that there was a probability of intensified gas lighting superseding arc lighting in Albert Square, Manchester. A good show had been made with intensified lighting in the new School of Technology at Manchester; and it would be a great thing for gas to be brought into successful competition with an electric supply, in the heart of a very thickly populated district, which had earned for itself some notoriety at any rate—if they could say no more for it. His own experience with street lighting had been principally with the Kern burner. They began with the "C" burner; but latterly they had put in some 500 Kern burners in ordinary square lanterns—the average consumption of mantles being just over four per annum. Although the lanterns were supposed to be storm-proof, there had been occasions when 25 per cent. of the mantles were destroyed in a single night. They had two experiences of this kind last winter. Speaking generally, there could be no comparison between the effect as regarded lighting with the incandescent system and with flat-flame burners. The additional cost should not be considered for a moment, when they took into account the increased efficiency to be got from the mantles in the streets. The question of replacing the flat-flame burners by mantles was merely a matter of expense. In his town, there were some 2500 lamps; and to supersede them all at once would be too large a dose for the undertaking to swallow, especially as they were such sinners as to provide the whole of the public lighting at the expense of the Gas Department. In his opinion, the relegation of flat-flame burners to oblivion as far as street lighting was concerned was simply a matter of time; and the sooner it took place, the better they would all be pleased.

Mr. H. TOWNSEND (Wakefield) said Mr. Brearley's paper was one of the most valuable that had been contributed to the Institution. The present was a very opportune moment for bringing the matter forward. The experiences of Wakefield were like those of most other towns. They lost nearly all the factories some time ago; the great bulk of them having gone in for lighting by electricity generated on the premises. There seemed to be a new movement on foot—in his district, at any rate. Some factories which had given up gas and adopted the electric light were now abandoning it in its turn, and installing incandescent gas with proper anti-vibratory fittings; a couple of mills in his own district having taken that course. He had seen it stated recently in the local papers that a good deal of short time was being worked in a particular part of Wakefield, owing to the breakdown of a dynamo which supplied the electricity for the lighting of the factory. The firm to whom the factory belonged were formerly customers of the Gas Company, so he called on them and offered to see them out of the difficulty by installing incandescent gas-lamps. He was received very cordially, and, though they had made arrangements to have a larger dynamo, he had hopes that his visit would lead to good results in the future. He had also heard of one or two firms who were contemplating replacing their flat-flame burners by electric lights. He had called on some of these firms, taking with him samples of a suitable burner with proper anti-vibratory

fittings. He was glad to say he had convinced one millowner that it would pay him better to fit up his mill with incandescent gas than to go in for electric light; and with another one he thought he had sown seeds which would bear fruit in the future. Of course, it would be utterly impossible for anyone to digest the mass of figures which Mr. Brearley had laid before them, and criticize them off-hand; but as confirming what that gentleman had said, he (Mr. Townsend) might mention that one of the firms who had recently reverted to incandescent gas lighting had replaced 498 16-candle electric lamps by 240 incandescent gas-lamps with anti-vibrators, which was rather less than 50 per cent. Referring again to the discussion which he had with a firm who had adopted the electric light, he noticed that in making a comparison between the cost of that illuminant and old flat-flame burners, they totally ignored the cost of the current. Although they had 1700 lamps, they said it made very little difference in the cost whether the dynamo was running or not. He told them that to produce sufficient current for 1700 lamps it would take 150 to 170 horse power, and that it was ridiculous to say that this could be produced for nothing. They could not help entertaining the feeling that managers of mills were, like many other people, so prejudiced in favour of the electric light that they made wrong bases for their calculations. Even Mr. Brearley said nothing in his figures about the cost of the current, but made his comparisons without taking it into account. Even then incandescent gas stood the comparison very well indeed, and showed considerable economy. But he thought the figures appearing in print without the cost of the current being considered would place them in rather a false position; and attention ought to be drawn to the fact, to prevent mischief arising from the omission. One millowner on whom he called observed that if he adopted the incandescent gas-light he had really no one to look after it. To this he (Mr. Townsend) replied that the cheapest way was to have one of his employees specially told off for the job; but if there was any difficulty in that, the Gas Company would undertake the maintenance of the lamps for 4d. per burner per month. He also informed him that for a large quantity, such as would be in use at a mill, they would be happy to do it at cost price. It was found that the knowledge on the part of the millowner that, if there was any difficulty in keeping the mantles, &c., in order, there was some other source to fly to, had very considerable weight with him. The charge of 4d. per burner per month for maintenance in Wakefield had not covered expenses. For the June half year, the income received was £12 6s.; the expenditure being £20 7s. 7d., including the fitter's time, which was £5 4s. 9d. In the October quarter, the income was £7 3s. 3d.; the expenditure, £10 1s., including the fitter's time, £5 9s. 6d. So that for the June half year they lost £8 1s. 7d., and for the October quarter £2 17s. 9d. He thought the reason of this was that in Wakefield they seemed to get all the extravagant people. Even though this account showed a loss against the Company, he was of opinion that it was a wise investment. They had just lit up Wakefield Cathedral throughout with incandescent gas-lights—a splendid effect being produced, which was a very good advertisement for them. But the Cathedral people would not have entertained for a moment the question of lighting up the building with Welsbach mantles if the Gas Company had not been prepared to take the maintenance off their shoulders. He contended that, whether it paid them or not, it was a wise investment. He was rather glad, in one sense, that it did not pay them, because the careless and extravagant people were far better in their hands than if they were looking after themselves. This class of people, if left to manage the mantles themselves, would very soon revert to flat-flame burners, electric light, or oil-lamps; they would not stand for long the great outlay and trouble consequent upon their carelessness. He kept an accurate record of all the people they had to deal with, so that they could see how the system was working. Since taking out the figures he had just given to the meeting, he called on three or four of the most extravagant people, and pointed out to them that they would have to mend their ways. He was glad to say that two of the worst sinners had acquiesced in his suggestions, and had decided to adopt anti-vibrator fittings. As an illustration of what they had to contend with, he might mention that one place they supplied was a large carpet-shop. The floor above was a room where most of the dancing in Wakefield was carried on; the result being that, after a dance, most of the mantles required renewing. He was glad to say that the proprietor of this shop had agreed to put in anti-vibratory fittings. These were so effective that they not only rendered incandescent gas lighting suitable for mills, but made it a success in boiler-works, where there were steam-hammers and hydraulic riveting-machines in operation. If they could successfully tackle works of this class, they could do so with any manufactory in the country. One other matter he wished to refer to was the question of insurance. He must say that what Mr. Brearley had told them was entirely new to him. The point had not been raised in any discussion he had had with the millowners. He was not aware that a higher rate was charged for incandescent gas lighting than for either flat-flame burners or the electric light. He thought this was a very serious matter, which they as an Institution, and the gas industry as a whole, should see into. As Mr. Brearley had put it, it simply arose from want of experience on the part of the Insurance Offices; and the sooner they gave the offices more information on the subject, so that they could alter the state of things, the better it would be for their industry. With regard to Mr. Buckley's paper, he might inform them that they had recently lit up several districts in Wakefield with Welsbach mantles; but they had no control over the lamps. They were simply the agents of the Corporation; the latter supplying the mantles and keeping them in order. The Lighting Inspector appointed by the Corporation reported that in one district, which was about as difficult as possible to light with incandescent burners—being very high and bleak, exposed to all the winds that blew—the renewals of mantles had averaged 3·2 per annum. At first they fitted them with Kern mantles, and supplied anti-vibrators. These were at first unsatisfactory, and the lamps not wind-proof. They set to work to put them both right; and when they had done this, they had quite a different experience from Mr. Buckley's. After a gale of wind, no matter how hard it blew, they did not have more than the normal number of renewals. His opinion was that the extra trouble with the mantles after a gale of wind was due to the lanterns not being properly constructed and made wind-proof. They lighted all their lamps with a torch; and notwithstanding this, they had only about 3·2 renewals per annum.

Mr. R. G. SHADBOLT (Grantham) first wished to draw attention to the fact that Mr. Brearley had taken up a standard which none of them had taken up before, but had approached the subject from the point of view of the millowner. By the paper which he had contributed that day, he appealed to the millowner more than did any other contribution that had been laid before the Institution; and he was sure this would bear good fruit. Mr. Townsend had said that he had not digested all Mr. Brearley's figures; but he could not help wondering what would have been their fate if he had had time to do so. Mr. Townsend spoke of charging 4d. per burner per month for looking after the incandescent burners. Were they monthly visits?

Mr. TOWNSEND: Yes.

Mr. SHADBOLT said he would like to know from any of the members who had gone in for the maintenance business if they confirmed the view that it was necessary to inspect the burners fortnightly, because it went without saying that the fewer visits that were necessary the cheaper it could be done. Mr. Townsend had told them that the only way that he got over the vibration caused by the dancing in the room overhead was by putting in anti-vibrators. But then, subsequently, it appeared that an anti-vibrator which was sufficient for this purpose would not stand a puff of wind at Formby or at Wakefield.

Mr. TOWNSEND explained that they were not the same anti-vibrators.

Mr. SHADBOLT said that Mr. Buckley's paper was of exceptional value, because it enabled them to arrive at the cost of a complete system of incandescent lighting; and he thought that there were many gas engineers outside their body who would be glad to refer to Mr. Buckley's paper in the future, when they wished to know the actual cost of incandescent street lighting in places where there was nothing else in vogue.

Mr. W. SEVERS (Wilmslow) remarked that Mr. Buckley had stated in his paper that he had quoted an inclusive price for incandescent street lighting, which had been accepted. He would like Mr. Buckley to inform them what the inclusive price was.

Mr. CHARLES WOOD (Bradford) said he could not take quite the same view with regard to looking after gas-fittings that an engineer with a company was able to do. He had not had much experience of the lighting of factories. He wished, however, to corroborate Mr. Shadbolt, and to express his satisfaction with the way Mr. Brearley had treated the subject from the point of view of a millowner. His brother-in-law happened to be the manager of a very large cotton-mill, which was entirely lit by incandescent electric light. In discussing the matter with that gentleman on many occasions, he had maintained that the current cost them nothing beyond the outlay on repairs—"a little fuel and a little water," he put it—and he had never yet been able to convince his brother-in-law that he was wrong. He was quite sure that this was the view which many manufacturers took. They reckoned the cost of their current at practically nothing; and this was a position which gas managers had to combat. They had had some experience with incandescent street lighting in Bradford; and one point which he should like to lay stress on was that, in his opinion, far too much importance was given to a small mantle account during the year. Anybody could have a small mantle account, if he was satisfied with a small light. He believed that years ago he had himself taken credit for having a small mantle account; but they had a larger one now, and yet he thought they were working more economically. With mantles at the present price, it did not pay them to keep one on after it had fallen in illuminating power. In Bradford, they had found it an advantage to have one man who was solely responsible for the lamps. Nobody else had anything to do with them; and he thought this system was an advantageous one. He considered it was a great mistake to have separate men going to the lamps to look after their maintenance; for in this case there was divided responsibility, and they never knew who was to blame for a defect. Then with regard to lighting the lamps, they had tried every system he knew of; but they still used the ladder and match for every one of their lamps, and they had over 12,000 burners at the present time. He knew of one city with over 20,000 lamps, which had recently gone back to the system of lighting with the ladder and match, and given up the torch, because they found that they

could thus maintain the lamps in a higher state of efficiency. He should like to take exception to Mr. Townsend's remark that, if a lantern were made perfectly wind-proof, it would withstand any storm. Some of the lamps in his district were 1200 feet above sea-level; and on one occasion he had 2400 mantles broken in a single night—a certain number of lamp-posts being blown down at the same time. He did not think, even if the lanterns had been perfectly wind-proof, that the posts would have been quite safe. It was necessary to have some efficient form of anti-vibrator, and to have the lanterns as nearly wind-proof as it was possible to obtain them. Their lanterns were made locally; and they glazed them themselves. The lantern complete cost them about 12s. 6d.; and they were found very satisfactory. He was hoping to have some little respite from the question of the buying up of gas companies, and so have a little more time to devote to the question of internal gas-fittings. He thought Mr. Townsend was to be congratulated upon what he had done recently with regard to the maintenance of incandescent gas-fittings. He was quite sure that if this could be done with only a nominal loss, they would in the long run effect a saving. He had in his mind a mill and several shops in Bradford which had recently discarded both the arc and incandescent electric light, substituting for them incandescent gas. But in order to keep their custom, they had to go in for maintaining fittings. There were all sorts of mantles which would not give satisfactory results; and it was the duty of all gas engineers to see to their maintenance, if they wished to hold their own with the electric light companies.

Mr. A. E. Buckley (Holmfirth) remarked that, as a visitor and an intending member, he would like to say a few words on the subject of the lighting of shops. When he took over his present position, he was asked by his Board to do what he could to oblige a factory owner who contributed a great deal to their consumption. Recently he had been rung up on the telephone to go to a factory which was short of light. On inspecting the place, he found that they had 375 flat-flame burners; and there was in existence a 100-light meter 37 years old, a 20-light meter 25 years of age, and a 2-light meter 36 years old. The service-pipe was a 2-inch one; and it was 300 yards long. He saw a chance for improvement there, and had the service-pipe taken out; putting in a 3-inch main, and also a 400-light dry meter. The work was commenced on the Saturday afternoon and completed by Sunday night. On the Monday, it was found that the lighting was very much improved. This was only an instance of what existed in his town at the present day; several of the factories having gone in for electric lighting in years gone by, owing to a similar state of things. The factory owner was of opinion that the light could not be further improved; but he assured him that he could improve it, if he were allowed to try a little experiment. He then fixed two incandescent lights to each lamp, and they were giving every satisfaction. In consequence of this, the factory owner had promised them a large order, which he hoped soon to receive. The 100-light meter that he had just referred to was tested at the works; and the Government Inspector confirmed his test, which was that it was 6 per cent. slow. This went a long way to explain the leakage account. With regard to street lighting, he thought there was ample room for improvement in very many towns, including his own. At the present time, he had 205 lamps, every one of which had a meter attached to it; and this, he thought, was a very extraordinary state of affairs. Many of these meters were 25 years old, and were in a very dilapidated condition.

Mr. W. Whatmough (Heywood) thought that Mr. Brearley had put the cost of the mantles very high compared with electric lighting. Last autumn he was consulted about fitting a factory with incandescent lights; and he offered to put in 25 lights to substitute 48 existing ones giving 50 per cent. less light.

Mr. Brearley pointed out that his figure of £108 included the service from the meter.

Mr. Whatmough said he did not think it was at all necessary to put in any additional fittings.

Mr. Brearley remarked that he was taking the case of a brand new factory.

Mr. Whatmough said there was a very cheap anti-vibrator which had found its way into his own district; ten mills having adopted it. On being asked what the name of it was, he said he was afraid it was an infringement. With regard to the question of maintenance, he had not the slightest doubt that in that lay the secret of giving satisfaction. In his district, they had only taken maintenance up this winter, and were charging 1d. per burner per month to pay for all that was required.

Mr. F. H. Pickles (Kildwick) said Mr. Brearley did not tell them whose anti-vibrator to use. In his opinion, the anti-vibrator system had given them the power of competing with the electric light by means of incandescent mantles. He had lately visited a mill in his own district where they had both incandescent gas-light and electric light in the weaving-mill and in the spinning-rooms. Comparing two spinning-rooms exactly alike, with 36 frames in each, in one they had four 16-candle electric lamps to a frame, whereas in the other they only had three incandescent gas-lights to a frame, which gave an infinitely better result, and, of course, was a great deal cheaper to the proprietor. There was a new wool warehouse opened in his town which had an installation of gas; and he was told by the proprietor that they were sorting wool by the incandescent gas-light. This work had never been done before by artificial light. They were sorting some of the dirtiest wool, with very good results; and the proprietor said he could easily distinguish the different qualities of wool. This had never been done before by any artificial light, not even the best electric light. In one part of his district, there were five incandescent lights which cost 10s. 6d. each when they were put up; but at the present time they could be obtained for 3s. They could, of course, be bought at all prices.

Mr. S. Meunier (Stockport) said they had to be extremely careful when they were making comparisons between two industries which were at present in competition, though he hoped at one time they would be joined. There were several points in Mr. Brearley's paper which he thought it might be advisable to consider, and which at any rate demanded some explanation. If there were any fault to be found on the side of electrical figures, undoubtedly their electrical brethren were going to pick the flies out. Putting himself on the side of electric lighting for a moment, he would ask how Mr. Brearley got the figure of 15 per cent. for interest and maintenance. Mr. Brearley might say that it did not affect the question, because he had taken the same amount both for electric light and gas. But if he would work out some further figures, he would find that it did affect the question. Fifteen per cent. on £387 meant a great deal more than 15 per cent. on £108; and it appeared to him to be a very high figure. In the first place, he took it that any cotton mill having anything like a sound position could borrow money at 4 per cent. At any rate, as far as his experience had gone, this was the usual interest paid for borrowed capital. The depreciation upon the plant he did not think could exceed 5 per cent.; and certainly maintenance upon the electric installation—irrespective of the renewal of lamps, which was a separate item, especially working only on the figure of 368 hours per annum—should not exceed 1 per cent. This brought them to a figure of 10 per cent. Taking that on the basis of the 15 per cent., he would find that his comparisons were very considerably altered, and that they did not appear to be quite as favourable to the gas as they did on his own estimate. Though he could thoroughly appreciate that, irrespective of the number of hours worked throughout the year, the interest on the maintenance of the incandescent gas system, whether he took the renewals of the mantles as a separate item or not, should be very nearly the same amount whether it be 368 hours or 3073, he did not think that it should be the same for the electric installation. A dynamo that had to work 3073 hours as against 368 hours, would require far more maintenance. Going back to the point of the millowner saying that practically his electric current cost him nothing, though it might very properly be pointed out that, with an increased indicated horse power, the coal bill must be more, if he would go further into the figures he would find that, after all, there was something to be said for the millowner's contention. If the indicated horse power were taken at 37, and it was remembered that the dynamo was being driven by the extra power which was to be had at most mills, it would be found that the consumption of coal was only about 2½ lbs. per indicated horse power; and if this were multiplied by the 37, it would be found that only 11 cwt. extra was required for driving the dynamo. Probably the mill would not use less than 50 or 60 tons a week; and 11 cwt. on this would only increase the consumption by 2·5 lbs. of coal per indicated horse power. This slight increase might be put down to the effect of the coal being of a varying quality, or to a little carelessness on the stokers' part. It was hardly an appreciable thing. At the same time, taking the cost of generation, which one or two members had referred to, it was quite possible that, in the way these things were generally used, the labour item was practically nothing. The same man looked after the boilers as after the machines; and the attention required for the electric light fittings was very trifling. The renewal of the electric light lamps was a far easier matter than that of mantles. He thought it was quite possible to bring down the cost of the coal to ¼d. per Board of Trade unit. This was a fact which very naturally had been taken into consideration by millowners who had also compared the ease of working and the convenience of switching the electric light on and off. On the other hand, in his opinion the incandescent gas-mantle gave a very much better light, and at the same time would be more economical in the long run. It behoved them to do all they could to try and push their own method of manufacture. He merely made his suggestions to Mr. Brearley as pointing out that, in his opinion, additional care should be taken when making comparisons, lest it should be thought that they had distorted the figures for their own particular purpose. This was a feeling they should strive to avoid.

Mr. Townsend said he wished to clear up a little ambiguity. He had referred to two anti-vibrators; and in one case he had said that, to get a satisfactory result with the public lamps, they had to take the anti-vibrator out. Then, later on, he had said that they got a very satisfactory result by putting an anti-vibrator in. He did not wish to mention the names of any anti-vibrator, for reasons which would be apparent to them all.

The President said that they had had a most interesting discussion. There was one matter that no one seemed to have touched upon, and that was the inexperience of the lamplighter. In his case, he had followed out Mr. Wood's plan of having one man responsible for a certain district. One night it occurred to him that it would be well to follow the man round, and he found that about six out of sixty lamps were lit-back. It struck him that many of the complaints made about inefficient lamp lighting were caused by the stupidity of the lamplighter.

Mr. BREARLEY, in reply, said he was extremely obliged to all the gentlemen who had discussed his paper. He believed, with Mr. Ball, that they should do all they could to extend, and advertise the value of, the use of incandescent lighting in factories, and for other purposes. One of his friends to whom he showed a copy of his paper disagreed with the assertion that "the composite gas engineer of to-day may be relied upon to give the best advice," &c. His experience, he said, was that the average gas engineer was much behind the times, and exhibited an amount of ignorance which indicated negligence of lighting matters generally. There might have been some foundation for this statement in years gone by; but the average gas engineer now knew that if he did not keep thoroughly conversant with all developments in the sphere of public and private lighting, the very existence of his company or undertaking would be jeopardized. There were few of them so pessimistic as to say that many, if any, undertakings were in jeopardy yet, or likely to be. Mr. Townsend had spoken of the new movement that was being made by the users of electric light in favour of gas. He believed if gas engineers would be strenuous, this new movement would be very real. During the past week, he had had an order for 100 incandescent lights for a shed. The firm giving the order had sufficient power to provide electric lighting from their own plant, but they preferred to have incandescent gas. This showed that the millowners were becoming impressed with the superiority of incandescent gas lighting. He had advisedly omitted to take into account the cost of the current in dealing with the electric light, because the millowners told him that it cost them next to nothing. This had been practically confirmed by Mr. Meunier. What he had done was to consolidate his figures so as to be as fair as possible; and, if anything, he had erred in favour of electricity. The millowners must work out the cost of the current for themselves. They had found many electrical engineers touting for the fitting-up of factories—making all kinds of assertions, many of which he was quite sure could not be for a moment substantiated. They ought to see that they were not subjected to this kind of thing. Mr. Townsend had said that he had all the extravagant people on his system of maintenance. He was very glad to know that it was only the extravagant people who went on that system, because they had recently circularized their district to the effect that they were prepared to maintain incandescent mantles for 9d. a quarter, renewing them once a month; and up to the present date they had only had six applications. He was very sorry more members had not spoken on the subject of the insurance of factories. As an Institution, they ought to bring pressure to bear on the Insurance Companies when they were suffering from the disadvantage of increase in rates in some departments. He quite agreed with Mr. Shadbolt that he had endeavoured to look at the question from the point of view of the millowner. He was very glad indeed to have heard what Mr. Pickles said respecting incandescent lighting used for sorting wool. This reminded him of an amusing anecdote he heard the other day from one of the millowners, who told him that two girls were overheard in conversation as they left work. The first remarked: "Has it not been a dreadfully dark day?" to which the other replied: "Yes; but we have got the incandescent light at our factory, and it is better than daylight. I only wish it was always dark." He was indebted to Mr. Meunier for his criticism of his paper. He was almost sorry that there had not been more adverse remarks. In Huddersfield, the millowners could not now get money under 5 per cent. for manufacturing purposes, though it might be obtained at 4 per cent. on debentures. In these circumstances, he had taken the interest at 5 per cent., and the depreciation at 10 per cent. on the cost. If his figure was thought to be too high, it could be corrected; but he believed it was a reasonable one. He realized that the interest and maintenance would not be the same for 368 hours as for 3073 hours; but the difficulty of getting the exact factor led him to adopt 15 per cent. in each case. He did not wish to be unfair to the electric light in the comparison he had made.

Mr. BUCKLEY said he would like first of all to show his appreciation of the valuable paper which Mr. Brearley had contributed. He had no factories in his district; but one never knew how soon there might be some, and Mr. Brearley's paper would be always handy for reference if required. He congratulated Mr. Ball on the low maintenance which he seemed to have at Rochdale. He did not see why the lighting department should be at the expense of putting in an installation. He believed in every tub standing on its own bottom; and if he were in Mr. Ball's position, he should be inclined to kick against anything like that. He was afraid if Mr. Townsend were in the same position as they were at Formby, his renewal account would be more than 3·2 per cent. In one instance, they had what was supposed to be a wind-proof lamp blown practically inside out. He quite agreed with Mr. Wood that, when a mantle was done with, it should be replaced, and that the mantles should be kept well up to date. As to the anti-vibrators, those were made to withstand a shock coming in a vertical direction; there were very few manufactured now-a-days which withstood a shock coming in a horizontal direction.

Owing to the cause mentioned in the paragraph introducing the foregoing report, the list of office-bearers of the Institution for the ensuing year was incomplete, and the names of the new members could not be given. These omissions we now supply.

President.—Mr. S. R. Ogden, of Blackburn.

Vice-Presidents.—Mr. H. Townsend, of Wakefield, and Mr. S. Meunier, of Stockport.

Members of Committee.—Mr. J. H. Brearley, of Longwood, Mr. J. E. Lamb, of Altrincham; Mr. W. Severs, of Wilmslow; Mr. R. G. Shadbolt, of Grantham; and Mr. H. Fowler, of Derby.

Honorary Treasurer.—Mr. Thomas Newbigging, of Manchester.

Honorary Secretary.—Mr. H. Kendrick, of Stretford.

Auditors.—Mr. E. Lord, of Whitworth, and Mr. G. W. Lupton, of Otley.

New Members.—Mr. A. C. Bissell, of Sowerby Bridge, Mr. A. Botteley, of Leek, Mr. A. E. Buckley, of Holmfirth, Mr. T. C. Severs, of Pinxton, Mr. R. Watson, of Doncaster.

SOCIETY OF ENGINEERS.

The Forty-Eighth Annual General Meeting of the Society was held on Monday last week, at the Institution of Mechanical Engineers, Storey's Gate, Westminster, by permission of the President and Council of the Institution. The chair was occupied by the President (Mr. Percy Griffith, M.Inst.C.E., F.G.S.). The following gentlemen were duly elected by ballot as the Council and Officers for the ensuing year: As President, Mr. J. Patten Barber; as Vice-Presidents, Messrs. D. Butler Butler, N. J. West and Maurice Wilson; as ordinary members of Council, Messrs. J. Bernays, G. A. Pryce Cuxson, G. A. Goodwin, W. H. Holttum, R. St. George Moore, H. Sherley-Price, J. W. Wilson, and E. J. Silcock; as Hon. Sec. and Treasurer, Mr. G. Burt; as Hon. Auditor, Mr. Samuel Wood, F.C.A. During the scrutiny, the President addressed the meeting, bringing before the members the salient points of the work of the past year. He referred to and commented upon the papers, and announced that the following premiums had been awarded by the Council for those read: The President's Gold Medal to Mr. T. Andrews, F.R.S., for his paper on "The Effect of Segregation on the Strength of Steel Rails;" the Bessemer Premium books, to Mr. A. R. Galbraith, for his paper on "The Hennebique System of Ferro-Concrete Construction;" a Society's premium book to Mr. B. H. Thwaite, for his paper on "British *versus* American American Patent Law Practice and Engineering Invention;" and a similar award to Mr. B. D. Healey, for his paper on "Recent Blast-Furnace Practice." The President also alluded to the visits which had been made to works of professional interest during the year.

After the meeting, a reception was held by the President, and Mrs. Percy Griffith, followed by a social reunion at which an excellent programme of vocal and instrumental music was carried out under the direction of Miss Gertrude Kemp. During the evening an interesting lecture, illustrated by lantern views, was given in the lecture hall by Mr. F. Lambert, R.R.G.S., entitled "The Crystal Caves of New South Wales; Stalactite Marvels of the Subterranean World." There was a large attendance of members and visitors; and the function which was the first of the kind held by the Society for many years, was highly successful in every respect.

On Wednesday evening, the annual dinner was held at the Hotel Cecil. Mr. Griffith occupied the chair; and the vice-chairs were filled by Mr. J. Patten Barber (the President-Elect), Mr. N. J. West (one of the Vice-Presidents), and Mr. Perry F. Nursey (the Secretary). After the usual loyal and patriotic toasts had been duly honoured, the toast of the evening—"The Society of Engineers"—was proposed by Mr. W. Whitaker, F.R.S. He emphasized the good work done by the Society by assisting the special institutions in gaining knowledge one from the other. It also gave a chance to young men to come to the front, and show what they were made of. The visits to works were of the greatest possible importance to all young engineers, and afforded them opportunities for obtaining knowledge which could not be given by the larger engineering societies. The President, in responding, said it was the great object of the Committee to keep the Society abreast of the times. It embraced all classes of engineers, and gave a chance not afforded by any other organization for the meeting of those engaged in different departments of the profession and the comparing of notes, and this was bound to produce good results. The toast of "Kindred Institutions" proposed by the President-Elect, was responded to by Mr. James Mansergh (Past-President of the Institution of Civil Engineers), who, in the course of his remarks referred to the investigation into the subject of "Standardization" now being carried on by the Institution, in connection with which no less than 121 members are engaged. He said this was really a national question. We had got behind our competitors in America, Belgium, and Germany, simply because these countries years ago had reduced the number of sections in use, and had therefore driven the English out of the foreign markets, and had even come to compete with them in their own country. This was one of the most important matters which the various engineering institutions had taken up. They thought it was only fair that the Government should contribute towards the cost of the work, as it was of general importance to the people of this country. At the close of the toast-list, the President proposed "The Secretary;" to which Mr. Nursey responded, and referred to his long connection with the Society.

THE FUTURE OF COAL GAS AND ALLIED ILLUMINANTS.

[A Series of Cantor Lectures delivered before the Society of Arts.]

By Professor VIVIAN B. LEWES, Royal Naval College, Greenwich.

III.—Monday, Dec. 8.

The alterations that are taking place in the conditions under which coal gas may be used for illuminating purposes are so entirely dependent upon the adoption of the incandescent mantle as a means of developing light, that one of the most important questions to be discussed must of necessity be the relation existing between illuminating power, calorific value, and the light that can be evolved from the gas when burnt in an atmospheric burner by means of the incandescent mantle. At first sight, there seems to be a wide discrepancy between observers on this point; and the literature of the past two or three years leaves one with a feeling of hazy uncertainty as to what relations really exist between the character of the coal gas and the light which the mantle will emit from it.

Herr W. von Oechelhaeuser came to the conclusion, from some experiments made upon the Dessau gas, that a reduction in its illuminating power causes an increase, and not a decrease, in the candle power of the Welsbach light. These experiments I will discuss later on. Some time later, Dr. Bunte read a paper before the International Gas Congress in Paris, in which he pointed out that the changes in the composition of gas, which reduce the illuminating power in flat-flame and argand burners to a very great extent, have but little effect in producing differences in the illuminating duty of the Welsbach burner. He showed, by photometric measurements, that the gas supplied in Berlin, Charlottenburg, Dessau, and Carlsruhe, although varying in illuminating value from 7·7 up to 10·9 candles, gave, in spite of this relatively wide divergence, no difference in the light obtained from the mantles. A series of papers by Messrs. White, Russell, and Travers, in America, gives the results of a research on the incandescent mantle and its behaviour. The authors came to the conclusion that the light emitted by the mantle has little or no relation to the illuminating power of the gas when burnt *per se* as a luminous flame, and will increase almost directly with the net calorific value; the increase being at the rate of 1 candle per cubic foot for every 4 calories increase in net heating value.

I especially notice these three sets of observations, as in each case the work was carried out apparently with the necessary precautions that should be taken in securing accurate results. But there have also been a large number of experimental determinations made, in which neglect of such important factors as the regulation of the air supply in the burner and the initial gas pressure have led to still more chaotic results. In order to fully grasp this most important side of the question, and to satisfactorily determine the real effect produced, it is necessary to consider the factors which govern the atmospheric burner and produce from coal gas the non-luminous flame which heats our mantle. In a lecture, on the theory of the atmospheric burner, which I gave before the Incorporated Gas Institute in 1897, I pointed out that the portion of the bunsen flame which heated the mantle, no matter what the composition of the original coal gas and the amount of hydrocarbons which it contained, if the burner were properly regulated as regards the air supply, consisted, as far as the combustible constituents went, of carbon monoxide and hydrogen; so that, leaving out of the question the initial heat given by the incomplete combustion in the inner zone, water gas, burnt without any admixture of air, would prove a highly successful method of developing light from a mantle.

The chemical changes taking place in the flame of the atmospheric burner were first studied by Blochmann; while Professor Smithells and myself have of late years done considerable work on the subject. The actions taking place are perfectly clear. An ordinary 16-candle coal gas requires from 5·5 to 6 times its own volume of air for its complete combustion; and if about half this volume of air is caused to mix with the gas before ignition at the burner-head, the gas is consumed in two stages, which give the dual character to the flame—the inner zone being produced by incomplete combustion at the expense of the previously admixed air, while the outer zone is due to the combustion of the products of incomplete combustion from the inner zone, which takes place at the expense of the oxygen from the outer air. Such a flame, however, is not the best that can be employed for heating the incandescent mantle. If the air supply be further increased, the inner zone, in which the primary combustion is going on, shrinks in size and becomes green in colour; and in an ordinary atmospheric burner, such as is used in laboratories, any further increase in the air supply before combustion causes the flame to flash-back to the bottom of the burner. But with various forms of burners for incandescent mantle heating, arrangements are made which prevent this; and the quantity of air can be still further increased. The popular idea of such burners as the Kern is that practically the whole of the air needed for the combustion is mixed with the gas before it burns at the burner-top. This, however, is an entire mistake. If such a result could be obtained, it would defeat its own purpose.

The best result is obtained from the incandescent mantle when a little over three-quarters of the requisite quantity of air is mixed with the gas. This gives an inner zone of a bright green, which appears to seethe and boil on the gauze top of the mantle burner; while the products of incomplete combustion escaping upwards from this zone consist of:

Water vapour	16 per cent.
Nitrogen	60 ,,
Carbon monoxide	9 ,,
Hydrogen	10 ,,
Carbon dioxide	5 ,,
	100 ,,

It is this mixture, escaping red hot from the inner zone, which, in its combination with the oxygen of the outer air, excites the mantle to incandescence. If, now, the aeration of the gas before burning is pushed beyond this point, the candle power yielded by the mantle falls instead of rises.

Various theories have been put forward to explain the wonderful light emissivity of the incandescent mantle; the latest being that of Messrs. White, Russell, and Travers, who conclude that the oxide of cerium is held in a state of "solid solution" by the oxide of thorium; and that this exerts a specific influence in altering wave lengths, so that the mantle emits more blue and green rays and fewer red rays—*i.e.*, converts more of the energy of the flame into light and less into heat—than does the ordinary flame that owes its incandescence to carbon particles. For my own part, I do not agree with this, and am in entire accord with the theory of Professor Bunte, that the process of combustion, and the heat given thereby, are stimulated by the catalytic action of the material of the mantle; and I consider that Luggin's experiment, which showed that the Welsbach material can be brought by catalytic action in a cold mixture of gas and air to a state of full luminescence, to be conclusive evidence on this point. Taking these factors with regard to the condition of combustion as existing in the atmospheric burner flame, it is evident that the calorific value of the original gas will exert a certain influence on the temperature of the inner cone of the flame, and that the superheating action of this upon the combustible constituents of the escaping gas, and the escaping products of combustion, will influence the temperature existing on and close to, the surface of the mantle. So that, supposing the burner to be working under the best conditions of air supply, the light emitted will follow the calorific value of the gas; but the differences between the illuminating value given will only be a very small proportion of the differences in calorific value of the two samples of gas.

I showed in this room, in 1900, that the effect of the superheating influence of the inner zone upon the outer portion of the flame is clearly demonstrated by using a Smithell's tube, by which the outer and inner zones of an atmospheric flame can be widely separated. Under these conditions, the superheating effect of the inner zone is reduced to a minimum. A mantle heated in the outer zone gives but a poor light; while on allowing the inner cone to rise in the tube, the luminosity of the mantle increases, until, when it has resumed its normal position in the centre of the flame, the mantle emits its full light. It is clear from this that the superheating by the inner zone plays a part in the light emitted by the mantle. In all the experiments I have made, however—with gases of varying illuminating and calorific value—I have failed to find any alteration in the light yielded by the mantle that would justify the adoption of such a ratio of decrease as that given by Messrs. White, Russell, and Travers—*i.e.*, 1 candle per cubic foot for a diminution of 4 calories; and I am forced to the conclusion from my own experiments that for calorific values, such as mixed gases possess between 12 and 18 candle power, with proper air adjustment to the burner, the loss of light given by the mantle is so small as to be far overshadowed by the alterations in light due to inequality of shape and other factors, apart from the calorific value of the gas.

The record of one experiment will show what I mean. A good mantle on a "C" burner was tested with a 17·7-candle power gas, and gave 20·6 candles per cubic foot of gas. Then 40 cubic feet of blue water gas were added to 100 cubic feet of the coal gas, and time given to complete the mixing of the two gases. On again testing, under precisely the same conditions as before, the mantle gave 17·7 candles per cubic foot of gas, and the light became a little unsteady. A collar was then fitted to the air-holes of the burner; and on regulating the air supply until the mantle gave the best results, a light of 20·1 candles per cubic foot was obtained. The details of the experiment were—

Description of Gas.	Illuminating Power.		Calorific Value.		Candle Power of Mantle per Cubic Foot of Air.	
	At 5 Cubic Feet Rate.	By 16 Candle Rate.	Gross.	Net.	Ordinary.	Adjusted.
	Candles.	Candles.	Candles.	Candles.	Candles.	Candles.
Coal gas	17·7	17·6	172	155·3	20·6	20·6
Coal + water gas (100 − 40)	11·5	14·0	136	121·8	17·7	20·1

The pressure was 1½ inches in each case; and the gas was burnt at the same rate of flow—*i.e.*, at 4 cubic feet per hour in both the experiments.

It is seen in this case that the loss of light given by the mantle

was half-a-candle for a loss of flame illuminating value of 6·2 candles, if tested at the 5 cubic feet rate, or 3·6 candles if tested in a rational manner. There was, moreover, a loss of calorific value in the gas equal to 33·5 calories; and, according to the ratio given by Messrs. White, Russell, and Travers, the 20·6 candles per cubic foot ought to have been reduced by $\frac{33·5}{4}$, or 8·3 candles, so that 12·3 and not 20·1 candles should have been found. It is clear, therefore, that, if care be only taken to properly adjust the burners, air supply, and mantles to the gas supply of a district—which could easily be done—the differences due to the lowering of the candle and calorific value of the gas become so small as to be negligible.

To my mind, this is a convincing proof of the truth of Dr. Bunte's catalytic theory of incandescence, as if the light emitted by the mantle be due not so much to the temperature of the flame, as to innumerable points of high temperature created on the surface of the mantle by the catalytic action of the ceria upon the hydrogen and carbon monoxide when once the temperature necessary to carry this on in the best way is reached, then the rise in temperature due to the combustion of a gas of high calorific value in the inner zone of the flame would merely increase the glow due to the effect of the slight extra heat on the mantle fabric. How small this is can be judged from the light emitted by a pure thoria mantle heated by the combustion of different grades of gas; and experiment shows that this is about the difference found in the experiment recorded with the 17·7 and 14 candle gas. The results upon which Messrs. White, Russell, and Travers based their views on the effect of the calorific value of the gas on the mantle, may be arranged in order in the following table, interpolating the value in B.T.U. as well as calories:—

TABLE A.

Comparison of the Heating Power of Gases with the Light given by the Incandescent Mantle.

Net Calories per Cubic Foot	B. T. U. per Cubic Foot.	Pressure.	Gas Burnt per Hour.	Total Power.	Candles per Cubic Foot.
Calories.	B. T. U.	10ths.	Cubic Feet.	Candles.	Candles.
60·24	240·96	22	7·58	41·92	5·53
62·30	249·56	20	7·20	69·63	9·67
67·03	268 12	20	4·93	27·13	5·54
108·90	433·60	20	5·20	91·00	17·50
112·11	448·44	20	4·93	102·93	20·69
130·90	523·60	20	3·56	77·83	21·86
140·55	562·20	20	3·45	87·04	25·60
144·30	577·20	20	3·25	82·65	25·40
147·86	591·44	21	3 40	96·67	28·48
153 83	615·32	20	3·50	95·91	27·40
156·10	624·40	21	3·10	92·24	29·75
162·96	651·84	20	3·00	76·30	25·43
169·60	678·40	20	3·15	103 73	32·90
219·28	877·12	20	2·05	45·90	28·94
239·38	957·52	20	1·80	74·96	41·63

The gas that heads the list with 60·24 calories net is blue water gas; and they find that, under the conditions of testing they employed, it gave with the mantles 5·53 candles per cubic foot. With a mantle of the shape adapted for the consumption of water gas, however, I have obtained the following results:—

Blue Water Gas Burnt in Argand Burner with Welsbach Mantle.

Pressure.	Gas Consumed.	Illuminating Power.	Candles per Cubic Foot.
	Cubic Feet	Candles.	Candles.
5-10ths.	6·2	120	19·3
8-10 ,,	7·0	137	19·8
11-10 ,,	8·0	145	18·1
12-10 ,,	8·5	145	17·0

The fact of 5·53 candles being put forward as what may be expected from blue water gas under the best conditions of burning, makes one feel disinclined to place a great degree of confidence in their results, which are manifestly wrong. A point which cannot be too strongly insisted upon is that the mesh of the mantle and the size of the opening at the top are important factors in the light emitted by different grades of gas, and should be attended to with the same care as the degree of aeration. Experiments soon show that the mantle best fitted for use with a rich carburetted water gas, such as is used in America, would give very poor results with a 10 or 12 candle gas; while the gas-ejector nipple suited to a rich gas is useless with a low-grade gas. It may be neglect of such conditions as these that has led to such manifestly erroneous deductions.

Herr von Oechelhaeuser's experiment with Dessau gas, which showed that a reduction in candle power, as tested with a batswing burner of from 13 to less than 2 candles, caused an increase of from 66·5 to 73·5 candles with the Welsbach mantle, may have been partly due to the conditions of air supply to the burner being better fitted for the combustion of the lower grade of gas. But there is another factor that must not be lost sight of, as it has an important bearing on the use of blue water gas as a diluent for coal gas. It is well known that the increase in volume of hydrogen and carbon monoxide caused by diluting coal gas with blue water gas shortens the flame and increases the intensity, and in this way makes the light of the flame whiter, due to the higher incandescence of the carbon particles. With the incandescent mantle, the same thing is noticeable; and I have many times obtained the same result as Herr von Oechelhaeuser. In the case of the Dessau gas, the lowering in candle power has been brought about by "stripping"—*i.e.*, removing absorbable hydrocarbons; and this would have the same result, as it increased the percentage of hydrogen present, and either this gas or carbon monozide has the same shortening effect on the flame as the mixture of the two (water gas).

An even more accentuated case of the same character came under my notice last year. I was testing the gas in a northern town, and found that, in the standard flat-flame burner, it gave an illuminating value of 20 candles. The gas was made from coal. It had an illuminating value of 13 to 14 candles before enrichment, and was brought up to 20-candle power by benzol vapour. I was struck by the poor light given by the mixture in the incandescent lamps of the town; and on testing it with mantles burnt both on the ordinary "C" and Kern burners (No. 4), I could only get a total illuminating value of 46 to 50 candles. I then tested the unenriched gas, which at that time had an illuminating value in the "London" argand of 14·11 candles, with the same mantles and burners as before, and got 80 to 90 candles without any trouble. The 20-candle benzolized gas had a calorific value of 608·8 net B.T.U.; the 14·1 candle coal gas 510 B.T.U. I could only assume that benzolized coal gas was unfitted for use with incandescent burners with ordinary adjustments, and repeated the experiment with the Kern burner, carefully measuring the rate of flow, and also trying the same coal gas enriched with petroleum spirit to 21·5-candle power.

No. 4 Kern Burner, with Mantle.

Enricher.	Illuminating Value of Gas.	Pressure of Gas.	Rate of Flow.	Illuminating Value.	Candles per Cubic Foot of Gas.
	Candles.			Candles.	Candles.
Petroleum spirit .	21·5	1·5	3·20	34	10·6
Benzol	20·0	1·5	3·45	46	13·3
None	14·1	1·5	4·45	90	20·2

In all probability, the explanation of these results is to be found in the fact that although the air holes of the burners were full open, they had been made for 16-candle coal gas, and gave too small an aeration for the enriched mixtures, and that if the nipples of the gas injectors had been changed, more normal results would have been obtained with the rich gas. I give these results, not as showing that enrichment reduces the lighting value that can be obtained from a mantle, but rather that the consumer is more likely to get his money's worth with a poor gas than with a doctored-up high candle value gas, as in nine cases out of ten the burner vendors never take the trouble to adjust the burners to the quality of gas with which they are to be used. Another question, which is an important one, is the effect of the pressure under which the gas is supplied to the burner upon the light emitted by the mantle. When the pressure of the gas rises, the visible effect is an increase of light from the mantle; but within the ordinary limits of gas supply—*i.e.*, between 1 and 4 inches pressure—this increase is more apparent than real. Mr. Walter Grafton last year read a most interesting paper before the Gas Institute, on the effect of quality and pressure on the efficiency of incandescent gas lighting. He gave a table of results obtained with various grades of coal gas and coal gas enriched by carburetted water gas, as well as a number of results obtained from mixtures of these gases with air. Taking his results for the coal gas and enriched gas only, and calculating the results at 1, 2, and 3 inches pressure to candles per cubic foot, the following table is obtained:—

Power of Gas at 16-Candle Rate, Corrected to 5 Cubic Feet.	Pressure of Gas.					
	1 Inch.		2 Inches.		3 Inches.	
	Total Light.	Candles per Cubic Foot.	Total Light.	Candles per Cubic Foot.	Total Light.	Candles per Cubic Foot.
Candles.	Candles.	Candles.	Candles.	Candles.	Candles.	Candles.
13·32	56·0	14·8	60·0	11·0	56·0	8·3
14·18	57·0	16·2	55·5	11·7	55·5	9·6
14·80	57·5	16·6	53·0	10·9	49·0	8·2
15·65	63·0	17·8	77·0	15·9	72·5	12·0
16·19	51·0	15·0	57·5	11·9	61·0	10·8
16·48	55·0	17·5	61·5	13·2	61·5	10·7
17·35	63·0	18·9	70·5	15 0	67·0	11·5
18·30	55·5	16·2	47·5	10·0	44·5	7·8
19·90	53·0	19·1	86·0	21·8	92·5	19·0
23·70	62·0	21·7	87·0	21·7	89·0	18·5

This shows that the general tendency of such variations of pressure is to decrease the candles per cubic foot of gas consumed, and that any increase of the total candle power is due to a very largely increased consumption. When, however, high pressures are used—*i.e.*, pressures of 8 to 10 inches—such as are employed in high intensity lighting on the Sugg, Keith, or other

systems, the high pressure enables some 10 cubic feet of gas to be consumed per hour, in place of the 3½ cubic feet supposed to be used by the "C" burner. So that nearly three times the amount of gas is burnt in the same time and area. There is thus a great increase in calorific intensity, with the result that over 30 candles per cubic foot can be obtained with London gas, and, of course, higher powers with a richer gas.

I have long since pointed out the importance of a thorough mixing of the gas and air drawn in by the atmospheric burner in increasing the light given by the mantle; and it was to do this that Chemin, Denayrouze, Bandsept, and Kern devised the special forms of burners associated with their names. The late Mr. Frank Livesey also showed that, by allowing the gas to take in the needed air some distance away from the burner-head, so that a length of travel should bring about a more thorough mixing, an enhanced effect could be produced. In the paper by Mr. Grafton already alluded to, he shows, by carefully made photometric experiments, that, by taking a mixture containing 15 to 30 per cent. of air with the coal gas after leaving the gas-meter, the light emitted by the mantle is increased to such an extent that far exceeds the ordinary results obtained for the same consumption of gas by other methods. This method of burning gas for incandescence is in practical use on the Continent, and is giving such excellent results that its use is rapidly spreading. It was as early as 1894 that Daus took out a patent for the production of an intensely hot flame by the use of a mixture of gas and air made by a suction air-drum driven by the gas-meter, which secured a constant mixture of the gas and air in the required proportions, and used the flame for heating Fahnehjelm combs. Later on, Doller, Fuller, and finally the "Selas" Company, took out further patents on improvements of the same idea, and under these combined patents have made a great success; the last installation being in the Thiergarten in Berlin, where the results attained are said to be exceedingly good.

The so-called "Selas" system consists of a small apparatus for the mixing of 2 volumes of air with 1 volume of gas immediately after the consumer's meter, and which is worked by a small water-motor using 1·2 litres or a little over ¼ gallon per burner per hour; or, if desired, it may be worked cheaply by an electric motor. The results obtained by this method (which is intended for use in the house), are that, with a consumption of 3·53 cubic feet of coal gas in admixture with air, a light of 134 English candles is obtained; while with a consumption of 4·24 feet of gas, the light rises to 167·9 candles, or 39·5 per foot. These results are obtained with Berlin, Stockholm, and Copenhagen gas, the illuminating power of which varies from 14 to 15 candles; while with a high-pressure system on the same lines, but with a compressor as well as a mixer, over 45 candles per foot are obtained with the same low-power gas. I have not yet tested the results myself. The fact, however, that they have been obtained by Mr. F. D. Marshall, at the Copenhagen Gas-Works, is a sufficient guarantee of their correctness; and I hope he will be able to give a paper and demonstration of these remarkable results at the next meeting of the combined Institutions. A very interesting phase of high-pressure illumination, which tends in the same direction, is to be found in some experiments made by Mr. Shadbolt on the effect of using air under pressue to suck in coal gas instead of the gas sucking in air. In order to do this, he removed the gas-nipple from an ordinary injector burner, and supplied air instead of gas through it, and sucked in the gas through the side holes. He found that by passing air in at a pressure of 32-10ths (3·2 inches), he got a consumption of 18 cubic feet of 17 to 17·5 candle gas, and a duty from the mantle of 678·5 candles, or 37·69 candles per foot.

High-pressure incandescent lighting is a means to attain a definite end, and that end is to create centres of high total illuminating value in order to compete with arc lighting for outdoor work and large buildings. There is no doubt that the amount of light which can be obtained from the surface of a single mantle can be enormously increased thereby; but I do not think carefully made tests would reveal so great an economy in the units of light obtained per cubic foot of gas consumed as one would expect. I frankly admit that the high-pressure incandescent companies have not shown any burning desire to submit their systems to my tender mercies; so that I have no personal knowledge of the actual results they are obtaining, or the cost at which it is being done. But Continental practice has gone so far ahead of ours that one can take a comparison of the candle units per cubic foot of gas consumed. Probably the greatest volume of light obtained by high-pressure incandescent gas lighting is in the "Millenium" burners, which, with a double mantle, give a light of 1800 Hefner candles. This is obtained by a consumption of 2250 litres of Berlin gas, or 79·46 cubic feet give 1578·9 English candles—*i.e.*, 19·8 candles per cubic foot—a duty which can be obtained with a good "C" burner and mantle, if one is content with a volume of light per burner of under 100 candles.

In the "Millenium" burner, I understand the gas is compressed under a pressure of over 6 feet of water. One knows, however, that more than 30 candles a foot can be obtained with Berlin gas at lower pressures, such as 10 inches, by the forms of apparatus in use here. But then the total volume of light is much smaller. This also shows still more clearly the value of mixing the coal gas with some of the air before compression (so as to get more thorough admixture), and then using this to suck in the extra air required. Mr. Marshall found, with the "Selas" high-pressure system, that, with Berlin gas and using a pressure of 24 inches of water, he could obtain a light of 766 candles with a consumption of 16·7 cubic feet of gas, or 45·8 candles per cubic foot; and it is clear that, by using lights obtained under this system over a large area, a great economy as well as a far better illuminating effect would be produced, as compared with half the number of lamps of double the candle power obtained by merely using gas compressed to 6 feet.

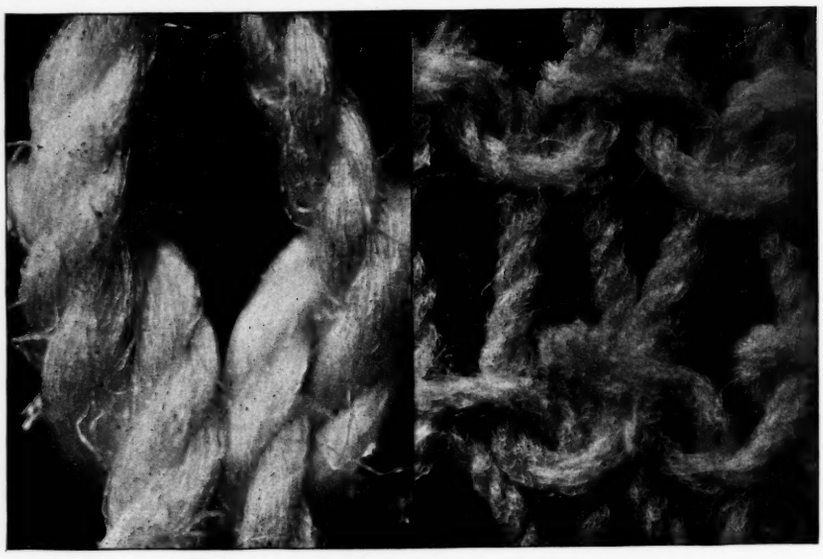
In considering the economy and utility of high-pressure lighting, it must be borne in mind that, although it may be politic and necessary to use what are practically blow-pipes rather than burners in order to create light which in volume shall compete with the electric arc, yet, up to the present, the mantle has not been made that will stand such usage for any great length of time. It is claimed for the "Selas" method of lighting that the life of the mantle is enhanced by 10 per cent. instead of being shortened; and if this be so, it would certainly accentuate its claim to rank before all other systems. After all said and done, however, the great and most important factor in incandescent lighting is the mantle; and we must now turn to that portion of the subject and see what improvements have been made, and what improvements are likely to be made, as upon this so much depends. Since the introduction of the present composition of 99 per cent. thoria and 1 per cent. ceria, it is safe to say that no improvement has been made in the composition itself, and, in this country, but little improvement in the physical condition of the mantle. Although the introduction of the beautiful artificial silk processes of mantle-making of Knofler, Plaissetty, and Lehner showed that it was possible to obtain a very considerable increase in the life and light emissivity of the mantle, yet, with the cheapening of mantles that has taken place during the past year, it would not be possible for a mantle made on this principle to be sold at a price which would compete with mantles of the Welsbach type, and which can now be bought at 3d. or even less.

In a previous course of Cantor lectures, I showed that the structure of the cotton mantle differed widely from that obtained by the various collodion processes, and that it was this alteration in structure that was mainly responsible for the increase in life; so that whereas the average of a large number of Welsbach mantles tested showed a useful life of only 700 to 1000 hours, the collodion type would average about 1500 hours—some mantles being burnt for an even longer period and still giving effective illumination. This being so, it was clear that one line of advance would be found in obtaining some material which, while giving a structure more nearly approaching that of the collodion mantle, would at the same time be sufficiently cheap to be able to compete in the open market with the Welsbach mantle; and this I think has now been successfully done. By the aid of photomicrography, the structure of the mantle can be clearly defined; and on examining the Welsbach mantle before and after burning, it will be noticed that the cotton thread is a closely twisted and plaited rope of myriads of minute fibres, while the collodion mantle is a bundle of separate filaments without plait or heavy twisting—the number of such filaments varying with the process by which it was made. This latter factor, experiment showed to have a certain influence on the useful light-giving life of the mantle, as whereas the Knofler and Plaissetty mantles had an average life of about 1500 hours, the Lehner fabric, which contained a larger number of finer collodion threads, could often be burnt continuously for over 3000 hours, and at the end of that period gave a better light than most of the Welsbachs after as many hundred.

It is well known that the plaiting of the cotton candle wick gave it that power of bending over, when freed from the binding influence of the candle material and influenced by heat, that brought the tip of the wick out from the side of the flame, and by enabling the air to get at it and burn it away, removed the nuisance of having to snuff the candle, which for many centuries had rendered this a tiresome method of lighting. In the cotton mantle, the tight twisting of the fibre brings this same principle of torsion into play; and when the cotton fibres saturated with the nitrates of the rare metals are burnt off and the conversion into oxides takes place, as the cotton begins to burn, not only does the shrinkage of the mass throw a strain on the oxide skeleton, but the last struggle of torsion in the burning of the fibre tends towards disintegration of the fragile mass. This, I think, all plays a part in making the cotton mantles inferior to their collodion brethren. It has long been known that if ramie fibre be prepared in such a way as to remove from it all traces of the glutinous coating, a beautiful silk-like fabric can be obtained from it, and that if still further prepared so as to improve its absorbent powers, ramie mantles could be made that have a life considerably greater than those of the cotton fabric. It seemed that this was a likely material to work upon in finding a cheap competitor in length of endurance to the collodion mantle; and a success has now been achieved in this direction which, I think, will play as important a part in the future of incandescent lighting as any improvement that has taken place.

Starting with ramie fibre and treating it in such a way as to remove all the objections which at first militated against its use for mantle making, and then making it into threads with the least possible amount of twist, Herr Buhlmann, of Berlin, has at length succeeded in making a mantle fabric superior in every way to that given by cotton. As is well known, he has employed ramie for very many years in mantle manufacture; but before the later

developments in treatment were arrived at, the results were by no means what they should have been, and many of the ordinary Krone mantles introduced into this country did not show the enhancement that was expected of ramie. These last improvements, however, mark a great advance; and he has at the same time invented an automatic process of burning and shaping the mantles, the effect of which cannot be over-estimated. In the old method of burning-off and shaping a mantle, the impregnated cotton fabric, after drying and shaping on a glass mould, was burnt first by means of a bunsen flame, and was then shaped by a blast blowpipe—this being considered necessary to harden and strengthen the weakly filament. In the few automatic burning machines that have been devised, this same lifting and lowering of the mantle over the blast blowpipe was employed; but it is impossible by any such means to get anything like uniformity in the condition of the ash or in the shape of the mantle. Yet Buhlmann has succeeded in getting both in the most simple and really effective manner.



Cotton Unburnt. Cotton Burnt.

Ramie Unburnt. Ramie Burnt. Ramie after Burning 3000 Hours.

Many years ago, I attempted to get uniformity in shape by making a burner-head of platinum gauze of the size and shape of the mantle required, and by putting the mantle fabric over this, tried to burn it down to the required dimensions. I found that there was no trouble in getting it to shrink satisfactorily down to the mould. But there it invariably stuck; and I was fortunate if I got a square inch of mantle off the platinum head. So I came to the conclusion that it was impossible to do this. However, Buhlmann's superior manipulative skill has led him to a well-deserved success. He makes a model of the mantle that he requires in iron wire gauze of triple thickness, and mounts this on a burner-tube, to which the gas is supplied, and into which air under pressure is blasted—giving, in effect, Mr. Shadbolt's idea of using the air under pressure instead of the gas. The result of this is that over the whole of the iron mould you have that green seething combustion that is such a factor in the inner zone of every well-regulated mantle flame; and the gas is burnt so rapidly that what would be the outer zone of an atmospheric burner flame is only a thin, almost imperceptible, layer above the sea-green sheath. The mantle, in its unburnt condition, is lowered automatically over this, a lever arm which lowers the mantle also turning on the right proportions of air and gas and starting a small sand-glass. The ramie fabric burns away, and the whole shrinks down until the green zone is reached, where the strong air-blast that is causing this green

Collodion Unburnt. Collodion Burnt.

zone prevents further shrinkage, and in the high temperature of the green zone the ash is baked and hardened for a definite period of time, marked by the running-out of the sand.

The burners are made up in batteries of the required number, and are all actuated by levers; so that the mantles are all put on, burnt off, and lifted off by a single movement of the lever arm. The same action that causes the lifting off also turns off the gas and air-blast. Nor is the extra burning needed to harden and strengthen the head neglected; for as soon as the mantle has shrunk to the mould, the lever brings down a ring blast on the crown of the mantle, so that none of the factors of success are omitted. It will be seen from this description that the iron gauze head of the burner shapes the inner green zone of the flame, and that this, in turn, shapes the mantle; so that there is no chance of adhesion between the mantle and the mould, as the two never come in contact. The result of this method of burning is to get a uniformity in size and shape and condition which it would be impossible to attain in any other way; and after having examined and fully tested this method of making the mantles in Berlin, I brought back to England with me two samples out of the number I had seen made. The asbestos loop of one unfortunately got fractured in travelling; but the other I was enabled to test for endurance and light-giving power. On the ordinary Welsbach "C" burner, it gave a candle power at first of only a little over 60 candles. But, to my astonishment, as week after week rolled by, the photometer indicated no decrease in the initial candle power; and for over 3000 hours—*i.e.*, from May 28 till Oct. 10, when it was accidentally broken in removing a cracked glass—it continued to give a light of 60 candles for a consumption of 4 cubic feet of gas at a pressure of 12-10ths.

This result is the most extraordinary one I have ever obtained. The tests were taken every ten days or fortnight; and the mantle had to stand the jars and jolts of being moved from the chamber in which it was burning to the photometer and back. Yet through the whole period it led a practically curveless life, and to all appearances, had it not been for its violent end, might have gone on for a considerably longer period. The mantle so tested, and giving these wonderful results, contained a rather higher proportion of the oxides—*i.e.*, the ash was a rather heavier weight—than the mantles in ordinary use for lighting in Berlin, which give a higher initial illuminating value of 80 to 90 candles at the start, and sink to about 72 candles after 600 hours, and then continue with but little loss of light. The result, however, shows that, by this system, uniformity of light as well as shape can be obtained. I am inclined to believe that this marvellous increase in life is not altogether brought about by differences in the ramie ash, the conditions of twist in the thread, and the number of fibres present in the thread, but is also largely due to the method of burning.

When an ordinary mantle is being burnt off, as is done by the Welsbach process, it is shaped and seasoned—*i.e.*, blasted in a high-pressure blow-pipe—and the light emitted is so intense that coloured glass screens have to be used by the girls in the works. I have always felt that this high temperature treatment was a mistake, as it vitrifies and renders brittle the filament, and thus apparently uses up a very large proportion of the light-yielding factor in the mantle. In the automatic burning of the Buhlmann mantle, however, the fabric is quietly and gently shaped and shrunk down to the mould head that gives it the required size and shape; and in this operation practically no light is emitted by the oxidized filaments. Yet the mantle so produced shows an elasticity and power of keeping up its illuminating value which I should never have considered possible.

On now examining the ramie fabric, the great differences which exist between it and the cotton fabric are at once apparent; and it will be noticed that it approaches much more nearly to the physical condition of the collodion mantles. Dr. Killing, who has also used microscopic enlargement as a method for investigating the variations in mantles, has come to the conclusion that the cotton thread consists of about 270 single fibres; while the ramie thread made in this way has only about 90 single fibres. The transverse section is, therefore, much greater with the ramie than with the cotton; and this remains *pro rata* the same after the impregnated material has been burnt off. In other words, the ramie thread contains only one-third the number of fibres that the cotton thread does; but each fibre is three times as thick as that of the cotton. It therefore melts and is destroyed by the heat of the flame less easily than the thinner thread of oxide derived from the cotton fabric; and as the fine ash fibres from the cotton fabric fuse more easily together, the lighting power of the mantle made in this way decreases far more rapidly than that yielded by the other type.

On examining the structure of the mantle which had been burnt for over 3000 hours, and comparing it with the structure of a freshly burnt-off mantle, Dr. Killing's view is thoroughly supported, as it will be seen that each fibre remains perfectly separate, and no signs of fusion into a solid mass can be seen. While inspecting the process of burning off, I took the opportunity of calibrating a large number of the mantles present in the drying room, and found an absolute uniformity in size and shape. The effect of this cannot be overrated, as it is not difficult to get burners giving a uniform shape to the flame, and with these absolute uniformity of result can be obtained. So that instead of seeing a long street lighted by incandescent mantles showing some giving an illuminating value of 100 candles while others are contenting themselves with a modest 25, a uniform effect can be arrived at; and with the length of life that I have indicated, an enormous advance in the position of incandescent lighting would take place.

Another direction in which the future of coal gas will benefit largely by a cheapening in price, owing to economies in manufacture and distribution, will be for use as a fuel. Already the ever-increasing demand made upon the Metropolitan Gas Companies during the day marks the advance of the utilization of coal gas for cooking, heating, and power; so that while the increase in the amount of gas used at night is only rising by some 3 per cent. annually, the day consumption shows an increase of 16 per cent. Directly it becomes possible to reduce the price of the gas to about 2s. per 1000 cubic feet, advance on these lines will become extremely rapid; and gas companies are naturally doing everything in their power to foster this development. It is, however, necessary, in order to further popularize gas as a fuel, that everything that can be done should be done to remove any prejudices that exist against heating by gas. There are many excellent gas-stoves on the market—well designed and giving high heating duty for the gas consumed; but there are also many that, both in their performance and in their effect on the atmosphere, are radically bad. Now that the gas companies have so largely taken over the sale and pushing of gas-heating apparatus, it is a duty they owe to themselves and to their customers to take care that only stoves of scientific construction and good efficiency should be supplied. Many of the worst stoves are the most ornate, and for that reason find their way into many homes, as they, in the first place, appeal to the eye of the housewife, and, afterwards, to the nose and health of the household. The result is a good customer is converted into an enemy of gaseous fuel. No gas-fires should be sold or let on hire which do not do a large proportion of the heating by radiation; and a gas company who sell a flueless stove, save for hall or passage heating, should be prosecuted.

A cubic foot of coal gas on its complete combustion yields 0·52 cubic foot of carbon dioxide and 1·30 cubic feet of water vapour. But if one does not mind breathing hot, polluted air, highly charged with water vapour, and getting chilled with cold walls, a bunsen burner, stood on the floor, is the most effective method of getting the whole of the heat of combustion into the air of the room. No flueless stove can do more than this. In order to get something to sell, stoves are constructed in which some of the water is condensed; and the public are gravely informed that this removes all deleterious products. But it is impossible to get away from the fact that if healthful heating is to be obtained, it is the solid objects and walls of the room that must be heated, and not the air; and that although some of the heat is lost thereby, a flue to take off all products is an absolute essential. The gas companies have it in their power to really govern the gas-stove trade; and unless they choose to take the initiative, it will retard the popularity of heating by gas to a serious degree. With all stoves in which solid bodies like asbestos are heated by atmospheric burners, a trace of carbon monoxide is always produced; and if there is not a proper flue passing well into the chimney, headache is added to the other discomforts.

Improvements in gas-motors and gas-engines are steadily going on; and as soon as the price of coal gas can be reduced sufficiently to attract this class of custom, a wide field will be opened up for it. The development of large gas-engines during the last few years gives promise of an entire revolution in our methods of procuring power; and it is highly probable that, within a very few years, the gas-engine will make great inroads upon the generation of power by steam. Already gas-engines up to 1500-horse power have been erected; while engines of over double that power are now under construction. In England, Messrs. Crossley Bros. and other well-known makers are producing a very large number of such engines for driving dynamos. Then it is stated that on the Continent, Messrs. Körting Bros. have made, or have under construction, 32 gas-engines with a total of 44,500-horse power, averaging 1390-horse power each engine; and the John Cockerill Company and several German Companies follow not far behind. With such a development of gas for motor purposes, it is manifestly the policy of the gas companies to make a determined bid for so wide a field of output; and if they can supply a clean heating gas with 460 to 500 B.T.U. heating power, it is clear that the convenience of doing away with separate generating plant would cause a large proportion of this business to fall to their share, if the price of the coal gas could be made to compete with a fuel gas of only 150 B.T.U.—that is, if nearly the same number of calories could be obtained by its use at the same cost.

Taking the imperfect review of the possibilities of the future and the teachings of the past, what conclusions are we to draw as to the gas of the future? My own opinion is that it will be a 12-candle gas, made by mixing blue water gas with coal gas—the blue water gas being introduced either into the foul main or used as an aid to distillation, so as to do away with any need of enrichment. This gas will have a calorific value of not less than 460 B.T.U. net, and a selling price of not more than 2s. per 1000 cubic feet; the economies necessary to reach this lower price being brought about by making the gas in the holder at 9d. to 9½d. per 1000 cubic feet and distributing it at a considerably increased pressure—the pressure being regulated down to 1½ inches at the entrance to the consumer's meter. Gas-fittings should be entirely taken over by the gas companies, who should supply incandescent fittings and mantles, and keep them in order at a small yearly rental; and where swinging brackets and other causes demand flat-flame

burners, the companies should fit nipples with broad slits regulated to burn at the lowest possible pressure. The reduction in price cannot be made at once; but as the cost of production permits, a reduction of price on all gas used for fuel and power purposes should be made first in order to expand consumption in that direction, and by levelling the load to prevent the necessity for the increase of holder accommodation at the same rate as the increase in consumption, while the increase in pressure will do the same thing for the mains. As years pass on, the power of the gas may be reduced to 10 candles; and the time will then be ripe for radical changes in our methods of carbonization, which will then follow more on the lines of the coke-oven illuminating gas plants now being introduced in America.

WEST'S IMPROVED COKE-CONVEYOR.

The question of mechanical coke conveying has now become one to which serious attention must be given by all gas engineers who are designing retort-houses with among the main objects that of economizing labour. The regularity with which coke can be drawn from retorts by power drawing machines assists the designer in forming a conclusion as to what is the best system to adopt for dispensing with that undoubtedly expensive means of conveying—hand labour and barrows—the coke from the retort-house to the yard; and, as years go by, the difficulty of dealing with this class of labour increases considerably. Year by year, on the other hand, gas engineers are introducing various methods of economically dealing with their coke; and therefore all useful information bearing upon the subject is welcomed by them. Among other inventors who have turned their attention to the question of hot-coke plant is Mr. John West, of West's Gas Improvement Company; and during the visit to their works last week to inspect the combined drawing and charging machine (which we introduce to our readers elsewhere), it was noticed that lately he has incorporated in his conveyors some important improvements, which aim at longevity, and have the recommendations of simplicity, fewness of wearing parts, as near unassailable strength as perhaps can be reached, and the *sine quâ non* of interchangeability of parts.

It is well known that the first difficulty to be overcome in connection with coke-conveyors is the wear and tear due to the gritty nature of the material handled, added to which the water used for quenching the hot coke washes the small gritty portions into all the bearing surfaces. At the outset, coke-conveyors were designed with very scant provision for dealing with these injurious conditions. But in Mr. West's improved type of conveyor, he has attacked the troublesome problem, and with, it would appear, considerable success. The trough of the conveyor is provided with false bottom plates loosely fixed; which are kept in position by strong angles on which the chain drags. It will be seen how easy is the question of renewal under such circumstances.

The conveyor chain is made 12 inches pitch, and has a joint pin $1\frac{5}{16}$ inches diameter by 8 inches long in the bearing. By a very simple contrivance, the pin is held in position without any additional piece—such as a nut, rivet, or bolt. The chain has only an average of two-and-a-half parts per foot run, and is very simple in construction and strong—both points of recommendation. The chain consists of a cast block, with eyes at each end for the joint pins, and an arm on each side, having an increased surface at the ends for the purpose of sliding along the angle-irons at the corners of the trough. The blocks are connected together by two steel side links and joint pins. These side links have slotted ends, which enable them to be passed over the head of the pin when the side links are at right angles with the chain blocks. They are then brought in line with the blocks when the projection at the sides of the cast-iron blocks prevent the side links being disengaged from the pins; and, by this means, they are held in position, and cannot be disengaged. This process is continued throughout the whole chain. Another feature of the conveyor chain is that in its whole length between its end supporting wheels, no movement of the chain joints takes place, so that the wear and tear is reduced to a minimum.

The sprocket chain wheels of coke-conveyors have frequently been made with teeth of a width which has probably been ample for the conveying of other classes of material, but not coke. In the improved West conveyor, the sprocket wheels have teeth $6\frac{1}{2}$ inches wide. It will therefore be seen that a large amount of bearing surface has been provided for at a point which has hitherto given much trouble in chains provided with small areas for meeting the conditions necessary for long life.

The ordinary pattern of the chain is designed to suit a conveyor 500 feet long; and the conveyor is speeded to travel at about 40 feet per minute. It may also be noted that the bulk of the coke is carried on the chain, and therefore does not get broken up in transit. We hope shortly to illustrate the details of this chain, with some examples of installations now at work. The Company have laid down a large plant for the manufacture of the chains and the Hunt chain—prominent among which plant is Brett's patent steam-machines for stamping out the steel links and pins. These machines do the work expeditiously, and must greatly reduce the cost. Altogether these improvements make a distinct mark in the efforts of conveyor makers to reduce the cost of upkeep of this type of plant.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting in New York.

(*Concluded from p.* 1553.)

Incandescent Burner Maintenance.

In the discussion which followed the reading of the paper by Mr. Dexter on the above subject (*ante* p. 1342), Mr. Clabaugh insisted on the importance of properly adjusting these appliances, and said that the gas company should undertake the work in their own interests, even if they had to do it for nothing. They should sell mantles and all kinds of appliances, and, if necessary, do the maintenance gratis. He knew many consumers who willingly paid several pounds per month for gas would kick at a charge of a few shillings for repairs to burners. Mr. Morris objected to the use of the term "gas arc," which was obviously borrowed from another line of business, and thought gas people should have sufficient inventive ability to coin distinctive titles. Mr. Forstall said that the English gas companies were taking up maintenance, either entirely at a fixed inclusive charge, or partially for renewal of mantles only; and he thought the importance of this department was not yet sufficiently appreciated. Mr. Ferrier was absolutely convinced as to the necessity for adopting a maintenance system. The question was how much consumers would be willing to pay.

Gas-Rates and a Franchise Taxation.

Mr. George M'Lean, of Dubuque (Ia.), read a paper on the above subject, and commenced by fully describing the law of the State of Iowa on the question. The City Councils had power to regulate and control the charges of gas or electricity companies, and could not dispose of this right by contract. A Charter or monopoly was limited to 25 years; and it was usual to adjust the prices at periods not exceeding five or ten years. It was possible for proceedings to be taken under this law that were actuated by motives of malice rather than by public demand, and no absolute protection against competition was afforded. But, at the same time, the regulation itself furnished good arguments against malicious proceedings or against the granting of a second Charter. The public sentiment was generally in favour of some sort of control over the charges of public companies; and in many cases it was a choice between regulation at fixed intervals or standing power to regulate at any time. He preferred, of the two, to concede the latter, as it meant that the power would be exercised less frequently, if at all. The question of assessment of public companies was of greater prominence than that of control of prices, and there was a growing demand for assessment on the basis of actual market value. He would assent to this basis provided that it was also extended to all other forms of taxable property. The laws of Iowa provided that companies should be treated exactly as firms or individuals; but they also provided for listing the value of lighting and some other companies in such a manner that the entire property, tangible or intangible, should be assessed. It had been held that in some branches of industry an excise or licence tax should be added to the value; but this, he contended, should only apply to amusements or luxuries such as saloon-keeping, and not to a company for the supply of a legitimate necessity. Seeing that religious, benevolent, or educational institutions enjoyed special exemptions, he thought that if anything a gas company should also be entitled to some relief. But he did not object to any method that was also applied to all other values. It had been said that the actual value of the concern over and above the structural value represented franchise value. But he argued that such a conclusion was neither fair nor logical. Then there was the profit basis. Gas companies would not object to this if generally applied; but they objected to discrimination. The profits were trading profits just the same as those earned by shop-keepers or by manufacturers, and in no sense of such an extraordinary character as to call for a special way of dealing with them. If such profits were unusually large, the proper way was to curtail them, and not to tax them. The consumer was entitled to fair prices, and was wronged if high rates were maintained; and this wrong was not righted by exorbitant taxation.

Discussion being invited, Mr. Egner thought it would be desirable to endeavour to influence public sentiment by a judicious use of some of the points cited in the paper, in the form of advertisement or otherwise. The Secretary remarked that those interested in gas companies should realize that the work of introducing control, regulation, and discriminating systems of taxation, was going on all the time, and that it was important to be prepared with a system that would be fair to both parties. Mr. Littlehales advocated properly regulated monopolies, and believed that a State Gas Commission was not only a benefit to the gas companies, but also to the consumers. Over-capitalization not only taxed the consumers unjustly, but it also crippled the business.

Cleaning and Repairing Gas-Stoves.

A paper dealing with this subject was read by Mr. G. Clarke, of Kansas (Mo.), who had 16,000 stoves to keep in repair. The process included stripping or taking to pieces, treating loose parts to a bath of hot lye, repairs proper, and reconstruction and

adjustment; and these were described in detail. For the cleaning, two large cast-iron tanks, 4 ft. by 3 ft. by 10 in. deep, were used—one charged with 20 lbs. of caustic soda, 74 per cent. dissolved in 40 gallons of water, and kept at a temperature of 160° Fahr., and the other with clean water, also heated. The castings, &c., required to remain in the lye for 3 to 4 hours, and the above quantity was supplied for 100 stoves. A cement used for joints of burners, &c., consisted of 10 parts putty, 1 part white lead, 1 part graphite, and sufficient lampblack to colour it. All sheet-iron work and parts not plated were painted with turpentine asphaltum, to which linseed oil had been added in the proportion of one teaspoonful per gallon.

Mr. Norris followed with some figures as to the cost of the repairs. He said that, during 1901, 2400 stoves were repaired at an average cost of 8s. 4d. per stove. The cost varied according to the make. Taking four prominent types, it ranged from 6s. 3d. to 9s. 3d. per stove; so that the cost of maintenance was not to be overlooked when deciding which stove to adopt. The cost of maintenance, exclusive of interest, figured out to 1s. 10½d. per stove per annum.

The Scott-Snell High-Power Lamp.

Mr. W. Cullen Morris, of Ravenswood (L. I.), read a short paper descriptive of some tests of the Scott-Snell lamp, and further illustrated his subject with some diagrams. His experiments were made with two lamps—the first being an air-compressing lamp worked at a constant pressure of 23-10ths for the gas and various air pressures ranging from 6 up to 33 inches of water, and the second a gas-compressing lamp worked at various pressures ranging from 23-10ths to 74-10ths for the gas and a constant air pressure of 32 inches. He remarked that the manufacture of the gas-compressing lamp had been discontinued, one important difficulty being a tendency to choke or gum up. The air-compressing lamp appeared to be fairly successful. It showed a steadily increasing duty with increased pressures of air; the best results being 42 candles per cubic foot of gas. The gas-compressing lamp gave a similar duty at ordinary gas pressures; but this was diminished with increased gas pressures. With 74-10ths gas pressure, the duty was only 24 candles per cubic foot. The burner used was an ordinary No. 4 Kern, and the consumption at ordinary pressures about 12 cubic feet, which was increased up to 19 cubic feet per hour at 74-10ths. The gas used for the experiments was a 25-candle water gas.

The Question Box.

In considering the contents of the Question Box, some difference of opinion existed as to the respective advantages of using all iron connections for meters instead of the usual lead pipe. The iron was rather cheaper, and not likely to be disturbed by flattening or kinks, but there was greater difficulty in changing meters, and some risk of the meter being strained by the fitter. For meters larger than 20-light the use of iron was not questioned. In Philadelphia a compromise had been effected by using lead outlet connections only. Some of the Western Companies used a swing joint with the iron connections that admitted 2 inches play. Mr. Searle said that iron connections were cheaper and did not require so much skill on the part of the workmen. Mr. Norris thought that the trend of practice was toward the use of iron. Mr. Butterworth said that iron was used at Columbus and at Denver (Col.), and found thoroughly satisfactory.

Advertising the Gas Business.

The report of the Committee on Advertising stated that they had issued a circular asking for subscriptions to an advertising fund, on the basis of 8s. 4d. per 1000 of population. Less than half the number of replies were received, of whom 80 per cent. supported the scheme; but the remainder seemed to fear that they might be paying for the benefit of non-subscribing neighbours, and made their support conditional upon all other companies also joining. Something had been done in the way of preparing a journal for issue to non-consumers in subscribing districts. This had eventually been taken over by one of the largest publishing houses in the country, who would by this time have the first number ready for issue, and would be prepared to supply at a fixed subscription in the usual way. The Committee urged that this plan should receive a fair trial, and added that they had other schemes under consideration that would be announced when matured.

The meeting concluded with the usual votes of thanks.

INTRODUCTION OF WATER GAS INTO COAL-GAS RETORTS.

The following is an abstract translation of a very interesting paper on this question, by Herr C. Borchardt, the Manager of the Remscheid Gas and Water Works. It was recently published in the "Journal für Gasbeleuchtung."

Water gas has been hitherto either taken direct into the hydraulic main of the coal-gas plant, by which plan hydrocarbon vapours are absorbed, and consequently smaller quantities of carburetting material are required, or else the two gases are mixed just before entering the holders. In either case not more than 20 to 25 per cent. of water gas can be added to the coal gas, as a greater addition would be likely to give trouble to consumers, more especially those using cooking apparatus or gas-motors. The consumption of benzol per 1000 cubic feet of simple water gas varies according to the different methods of applying it, and the standard illuminating power prescribed in the district. Although an addition of 20 to 25 per cent. of water gas is of great advantage, yet a larger addition would give still more favourable results at the present time, when the sale of gas coke has become almost impossible, and is unlikely to improve in the future.

At Remscheid, water gas has been brought direct into the retorts of the coal-gas plant since March last; and as a result, the addition of water gas could be increased to 40 or 50 per cent. without any inconvenience being apparent. It must be pointed out emphatically that the heating value of the gas remains almost constant; while the consumption of benzol is very moderate. Thus, with an addition of 10 to 15 per cent. of water gas, it is unnecessary to use any benzol; while an illuminating power of about 12 candles is maintained. The water gas is admitted at the far end of the floor of the retort, through a pipe with a cock, during the first hour of carbonization. Various attempts to introduce the water gas during the third or fourth hour of carbonization have been made. But the results have been unfavourable; and interruptions have occurred in the working. The admission of water gas must be limited to as short a time as possible; and the inlet cock must be opened directly after the retort is charged. Unfortunately, very much depends on the opening and shutting of the cocks by the works staff as required at different intervals of time; but doubtless automatic arrangements will soon be used for this purpose.

The whole apparatus at Remscheid was only arranged for experimental purposes; and it is to be rebuilt in the light of the experience derived from it. The experiments, which lasted over two months, have, however, proved that it is possible to add 40 to 50 per cent. of water gas to coal gas, and that, with this addition, the consumption of benzol only amounts to 45 to 50 ounces per 1000 cubic feet of water gas; while the calorific power of the carburetted mixed gas is only 3 to 5 calories per cubic foot less than that of ordinary coal gas. The experiments were made with settings of horizontal retorts. Further experiments will be conducted with settings of inclined retorts; and these may be expected to give at least as good results as with horizontal retorts. In any case, with these settings, the regulation of the supply of water gas will be simpler and more certainly managed.

The total production of gas for the year at Remscheid (123,550,000 cubic feet) was made up of 109,430,000 cubic feet of coal gas and 14,120,000 cubic feet of water gas. The water gas was added only in the six winter months—from Oct., 1901, to March, 1902. The quantity added ranged from 10 per cent. in October and March to as much as 45 per cent. in December; thus rendering it possible for the production of coal gas to be kept nearly uniform throughout the winter. The extra amount required was made up by the addition of water gas. Water gas can, of course, be added to the coal gas throughout the year; but it is of particular advantage during the winter time, when coke is difficult to get rid of. Adding 33 per cent. of water gas, the quantity of coke for disposal, which would otherwise amount to 50 per cent. of the coal used for gasification, can be reduced to 27 per cent. As regards the cost of water gas, careful calculations have shown that, owing to the small consumption of benzol consequent on introducing the water gas direct into the retorts, it is lower than that of coal gas. The author can confirm the hopeful views of the process of introducing water gas into the coal-gas retorts already expressed by Professor V. B. Lewes.—See "Journal," Vol. LXXVIII., p. 623.

Appended is a table showing the effect of additions of water gas on the illuminating and calorific power of coal gas, deduced from the author's experiments.

Table *showing the Effect of Additions of Water Gas on the Calorific and Illuminating Power of Coal Gas.*

Date.	Percentage of Water Gas Added.	Illuminating Power in English Candles.		Amount of Benzol Used for Carburetting.	Calorific Power *	
		Uncarburetted Gas.	Carburetted Gas.	Ounces per 1000 Cubic Feet of Gas.	Uncarburetted Gas.	
1902.					Gross	Net.
April 18	25	8·8	10·8	39	544	488
,, 19	30	8·3	10·5	51	536	480
,, 22	34	8·3	13·2	45	546	490
,, 23	32	7·9	12·0	50	516	460
,, 25	34	8 0	13·1	47	549	492
,, 28	42	9·2	13·0	45	565	507
, 30	45	8·3	..	55	567	508
,, 30	Nil	12·8	..	..	591	528
May 19	,,	12·2	..	..	..	..
,, 20	,,	12·3	..	..	570	508
,, 21	,,	12·3	..	..	584	522
,, 22	,,	10·6	..	..	573	512

* British Thermal Units per Cubic Foot.

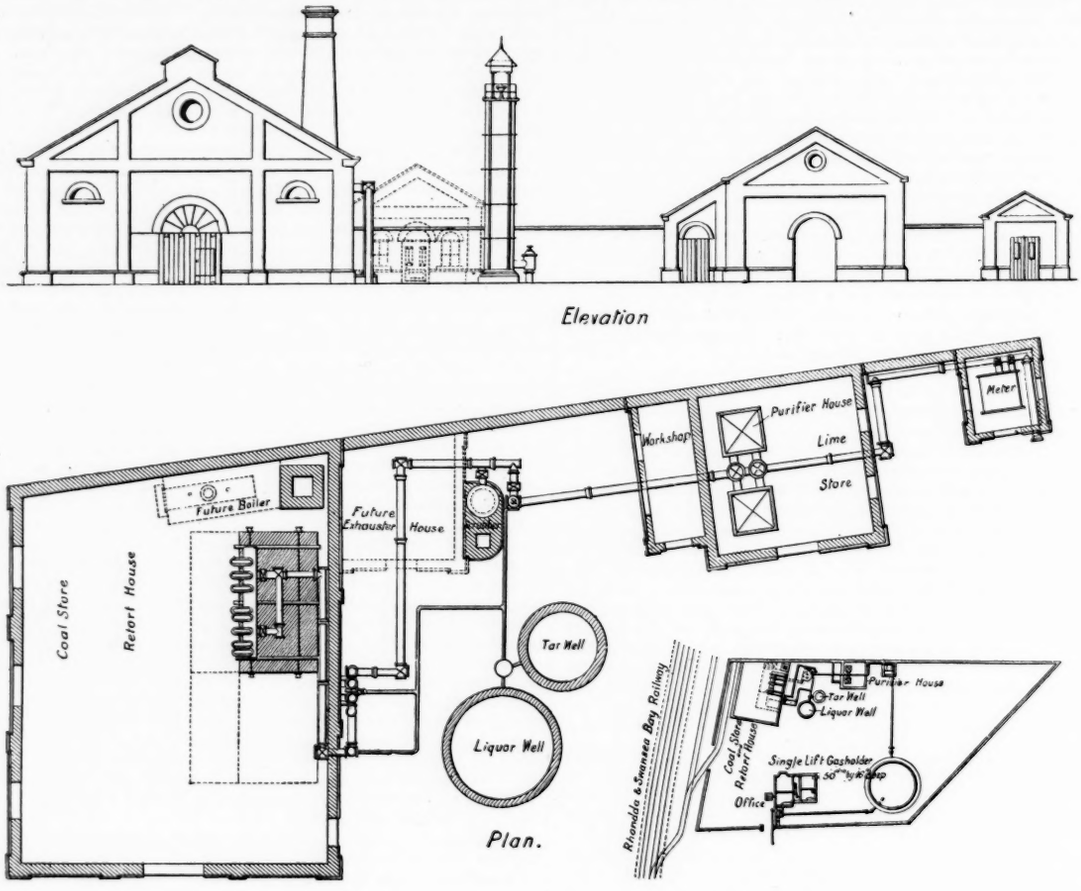
NEW GAS-WORKS FOR GLYNCORRWG.

A Design for a Small Plant.

A new gas-works has been added by the Glyncorrwg Urban District Council to the large number already existing in South Wales. The district has been previously supplied with gas from the Maesteg Gas Company's works, by means of a main laid through a tunnel a mile in length on the Great Western Railway. Owing to the difficulty experienced by the Maesteg Company for some years past in providing a regular supply, matters have been most unsatisfactory. A site was obtained adjoining the Rhondda and Swansea Bay Railway, near Cymmer, and new works have been erected to designs and specifications prepared by Mr. Robert A. Browning, Assoc.M.Inst.C.E., of Neath. The works have recently been started very successfully; and at last the district has been supplied with light for which it has been clamouring for a number of years.

The only site the Council were able to obtain was not an ideal one—in fact, almost the only recommendations the site possesses are its direct communication with the railway and an unlimited water supply. The works stand practically on a sloping hillside, and have therefore been arranged in the form of terraces. The highest side is nearest the railway; and advantage has been taken of this to bring the siding in at the top level, and run it alongside the coal-store, so that the coal may be discharged out of the trucks directly through openings in the side walls into the store. There is a drop of at least 8 feet between the level of the retort-house and the purifier-house. The ground itself is of a very treacherous nature, and was covered with peat to a depth of some 3 feet in many places. This had to be removed both from the interior of the buildings, and for the foundations—necessitating much extra work in bringing the various buildings up to the proposed ground level. Directly the peat was removed, water was invariably encountered; so that many difficulties were presented in the construction of the works.

The combined retort-house and coal-store (as will be seen from the plan) runs parallel with the railway siding. The building measures 60 ft. long by 45 ft. wide, and contains two arches for five retorts built on the Chester shallow regenerative principle. Provision has also been made for an extension of the retort-bench and for a steam-boiler adjoining the retort-settings. Space is reserved for an exhauster in the immediate future. Annular condensers and a tower scrubber have been fixed, and



THE GLYNCORRWG URBAN DISTRICT COUNCIL'S NEW GAS-WORKS AT CYMMER.

two purifiers—with provision for extensions when necessary. The workshop and purifier-house comprise one block of buildings; and the meter is in a separate house. All the buildings are of local stone, with yellow brick plinths, string-courses, and facings; and they have been finished and slated in a substantial manner, so as to withstand the heavy gales to which the district is so much subjected.

The gasholder, which is on the improved spiral-guided type, is 50 feet in diameter by 16 feet deep, provided for telescoping. It is contained in a brick tank. The governor-house is conveniently situated at the back of the Manager's residence, which has been built with every requisite, as the works are situated a considerable distance from the nearest habitation.

To convey the gas to the district it has to supply, it was necessary to lay an 8-inch main, two miles alongside the railway track; and many difficulties were encountered in carrying out this portion of the contract. For a distance of 300 yards, the railway passes through a rock cutting in the mountain side; and there was barely room for the main between the ends of the railway-sleepers and the retaining walls. Blasting the whole of this distance had to be resorted to without interfering with the railway traffic; and, to add to the trouble, a stream of water was continually running alongside this portion of the line. However, the main-laying operations, we understand, were carried out in a highly satisfactory manner. The pipe has been duly coupled up to the existing distributing main in the highway beyond the Cymmer railway station.

The contract (after having been advertised) was entrusted, in its entirety, to Messrs. R. & J. Dempster, Limited, of Manchester, and thereby they have added another complete works to the long list of those they have previously erected.

Arrangements are in progress for holding a Universal Exposition at St. Louis (U.S.A.) in 1804, for the purpose of commemorating the acquisition of the Louisiana territory from France in 1803-4. The exhibits will be grouped in classes, as usual. Under "Social Economy," profit-sharing, wages, and the public health will be dealt with; under "Liberal Arts," the science of chemistry, gas, water, and sanitation; and under "Manufactures," light. The offices for Great Britain and Ireland are at Sanctuary House, Tothill Street, Westminster, S.W., and the Resident Representative is Mr. G. F. Parker.

UTILIZATION OF BLAST-FURNACE GAS.

At the Meeting of the Cleveland Institution of Engineers, at Middlesbrough, last Tuesday, Mr. Cecil A. Cochrane, of that town, read a paper on "The Use of Blast-Furnace Gas in Gas-Engines." He began by directing attention to the fact that increasing competition is forcing the conviction on the minds of manufacturers that Middlesbrough will have to meet it by a more economical use of blast-furnace gas. He then referred to the utilization of this gas for driving engines, and mentioned that such an engine, working direct from the gas, had been in operation at the Ormesby Iron-Works for the past twelve months, and, after overcoming sundry small difficulties, it was running satisfactorily. The firm who built the engine had in hand orders for seven 600-horse power gas blowing-engines, to be worked by furnace gas, and two 250-horse power engines for producing electrical energy, to be worked with coke-oven gas. In describing the engine at work at Ormesby, the author pointed out that the fly-wheel weighed 33 tons, and the weight of the entire engine 160 tons; while it occupied a space 52 ft. 6 in. by 21 ft. 9 in. Reference was also made in detail to the manner in which the gas was cooled and purified as it travelled in the mains to the engine; many statistics being given to show the great success which had attended the efforts put forth in this connection. Mr. Cochrane said that—though he did not go so far as one enthusiast, who prophesied that the day was not far distant when iron will be a bye-product of blast-furnaces, and the furnaces become primarily gas-producers, and steam-engines would have to be sought for in museums—he thought it was not too much to hope that in the near future they would succeed in harnessing all the waste gas available at the furnaces. This gas, when purified from its accompanying dust, and conveyed to a central generating station fitted with gas-engines, might furnish all the electrical energy, not only to light Middlesbrough and the neighbouring towns and drive the tramcars, but to supply large manufacturers and small consumers with power, at a price at which it would be impossible to produce it from coal.

In the discussion upon the paper, Sir Thomas Richardson congratulated the author of the paper and the firm with which he was connected on what they had done on behalf of the district, where all that entered into the manufacture of pig iron was at their doors. He felt convinced that, after what they had just heard, the number of advocates of steam-engines in blast-furnaces would be fewer than before. Mr. D. B. Morrison pointed out that for every ton of iron produced in a coke-fed blast-furnace there were 9 million British thermal units of gas which could be utilized to generate power. There had been reluctance to try blast-furnace gas-engines in the district, on account of the low calorific power of the gas; but Mr. Cochrane had, by his investigations, overcome the difficulty, and thereby had given confidence to the manufacturers, and a great impetus to the trade of the district. Mr. Baglay expressed the belief that, while our Continental friends had solved the question of using blast-furnace gas for gas-engines, Messrs. Cochrane had worked out the problem of using Cleveland gas in the same manner. At the close of the discussion, Mr. Cochrane replied.

ESTIMATING PRUSSIAN BLUE IN SPENT OXIDE.

The following account of a process devised by Dr. R. Schwarz, for the estimation of prussian blue in spent oxide, is abstracted from his original communication in a recent number of the "Chemiker Zeitung."

The author recommends a process which, he says, yields a perfectly clear solution of sodium ferrocyanide, and admits of a test being readily applied to ascertain if the conversion of the blue has been complete. A layer of well-washed sand, ¾-inch thick, is put on the bottom of a wide-mouthed bottle holding 100 to 150 c.c. The bottle is provided with a plug perforated to admit two glass tubes—one of which ends directly beneath the stopper and is connected with a raised bottle of distilled water, while the other, which serves for emptying the bottle, passes through the sand almost to the bottom. This tube is closed at its lower end by a cap of brass or bronze gauze, through which the sand cannot pass. On the layer of sand, 50 grammes of the prepared spent oxide are placed, and decomposed in the vessel itself by a solution of soda and caustic soda. The stopper, with attached tubes, is then inserted; and after remaining about half-an-hour on the water-bath, or after one to two hours' digestion in the cold, water from the raised bottle is introduced through the second tube, so that the extracting liquid is filtered by the sand, and runs off, by drops, from the other tube (which is U-shaped) into a litre flask. This outflowing liquid is perfectly clear and bright, and is driven out by the inflowing water, which at the same time effects the washing under the pressure of the column of water. When the flask has been filled up to the mark, the extraction will be complete if the work has been properly carried out. It can be checked by collecting a little of the outflowing liquid in a beaker, and observing whether it still has an alkaline reaction, and whether, after acidifying with hydrochloric acid and adding ferric chloride, blue is still produced. This should not happen if the work has been efficiently carried out. If, however, extraction should not be complete, the washing can be continued, and a two-litre flask used in place of the litre flask. Finally, the whole of the liquid is brought together. If the test portion of the washings has not an alkaline reaction, and it is necessary to ascertain whether all the blue is actually dissolved, the raised bottle, containing distilled water, is changed for one containing dilute solution of caustic soda. For the determination of the prussian blue, the author prefers to precipitate it by ferric chloride in the extracting liquid after acidification with hydrochloric acid, and to weigh it as ferric oxide, to making the determination volumetrically. 560 parts of ferric oxide are equivalent to 860 parts of prussian blue.

THE COATING OF CAST-IRON PIPES.

By W. H. Humphreys, of York.

[Extracts from a Paper read before the British Association of Water-Works Engineers, with a Summary of the Discussion.]

If an apology were required for introducing a subject of such apparently minor detail of water-works engineering as the coating of cast-iron water-pipes, the author thinks it sufficient to call attention to a case which, in his own practice, required weeks of unremitting attention, much worry and expense, the wasting of large quantities of water when it could ill be spared, and the inconvenience caused by the repeated shutting-off of an extensive district.

The circumstances were as follows: Early last year an extension of mains was carried into a country district to supply a large military camp, a village, and numerous houses and farms *en route*. The extension comprised 1250 yards of 9-inch, over 6000 yards of 6-inch, and 1300 yards of 3-inch cast-iron pipes, coated according to the usual specification. All the pipes were laid at a depth of 3 feet—the 9-inch and 3-inch under macadamized roads; the 6-inch partly under macadam, partly under a cinder footpath, but for much the greater distance under the grass which fringed the roadside. The subsoil under the footpath and the grass wherein the 6-inch pipes were laid, was first of clay and marl; but afterwards, and for more than half the distance, of light sand with a slight admixture of marl. The specification referring to the coating required that, "before the pipes became affected by rust, they should be immersed in a bath of Dr. Angus Smith's bituminous composition, so as to produce, both within and without the pipes, a smooth and even covering of dry, hard, and irremovable black varnish." The pipes were jointed with hemp yarn and molten lead; valves and hydrants being fixed at about every 500 yards for flushing. Incidentally, to afford a temporary supply to the camp by means of hose-pipe during the progress of the main-laying, as much as 4000 yards of hose was in use at one time.

The first section of the main was brought into service on April 7, and from that date until July 15—a period of 99 days—no complaint whatever was received as to the condition of the water. On the latter date, however, complaint was made that, for three or four days previously, the water had had a taste and smell of tar, which appeared somewhat strange when occurring so long after the pipe-line had been completed. Some slight indication of such taste and smell might have been forthcoming, without creating surprise, at the commencement of the use of the main; but certainly not so long afterwards. The temperature for several days previously had been extremely high; and about one-half of the pipes being laid in the light soil referred to, and on the north side of the road where the sun had full power, it appeared possible that these circumstances might, in some measure, account for the trouble then occurring. Moreover, only a limited quantity of water was then being used from the main, as the camp was practically empty; this causing the water to be more or less stationary in the pipes. Samples were immediately procured; and they fully justified the complaints. In addition to the smell and taste of tar, there was a large quantity of matter in suspension, which, on careful examination, proved to be red oxide—an unmistakeable sign of corrosion having set up within the pipes. Steps were at once taken to have the mains thoroughly flushed, and samples of the water analyzed for the purpose of reassuring the consumers. The professional analyst certified that the water was pure and free from contamination, but had a tarry taste and smell, due, no doubt, to the coating of the pipes. This, he thought, would soon wear off, and stated that, meanwhile, there was nothing injurious in the samples. Analyses of many samples of water made in our own laboratory bore out this testimony.

In the meantime, the main was well flushed in the neighbourhood where the evil appeared the most pronounced; but for the first two days this scarcely had an appreciable effect. Increased efforts, however, effected an improvement during the next three days, but failed to entirely remove the trouble. Only the 6-inch and 3-inch pipes were affected; there being no complaint along the line of the 9-inch pipes, though all came from the same foundry, and were delivered at the same time. The flushing was then somewhat relaxed; it being hoped the evil might disappear of its own accord. But this was not the case, as two days later the taste and smell reappeared stronger than ever, rendering the

water quite unusable for drinking and cooking purposes. It then became necessary to take stronger measures. A 6-inch branch was fixed near the end of the main, so as to empty it into a stream; and three additional hydrants were also fixed. The branch was kept full open for twelve hours; so that a rush of fresh water from the works could pour through the main and effectually cleanse it. This, however, although tried again and again, failed to altogether remove the taste. The main was then shut off entirely; all the hydrants were opened; and every drop of water taken out of the main by means of hand pumps. A fresh supply, under the highest pressure, was then sent through the pipes; and this method proved to be the most effective, as during the next day samples were taken from every tap, and with two exceptions not the slightest taste or smell could be found. These favourable conditions, unfortunately, lasted only for a very few days, as the taste reappeared, notwithstanding that the flushing was never entirely discontinued. Some improvement followed the continuous flushing. It appeared, however, to be quite hopeless, to expect to eradicate the evil by these means only, and that it would have to work out its own cure, which it eventually did, as, early in September, after 58 days of endless trouble, the taste disappeared altogether. During all these operations, the consumers were put to much inconvenience; yet they, with kindly consideration, appeared quite satisfied the fault was not chargeable to the Company, and that every means were being adopted to remedy it.

Fortunately in this case the source of supply is practically unlimited; but it can easily be imagined how few authorities were, during the extreme drought of last summer (1901), in a position to spare the great quantities of water necessary for the purpose of remedying the results arising from a fault which can only have occurred, through great carelessness, in coating the pipes. The questions naturally arising are: (1) What was the origin of the evil? (2) Was all done that could reasonably be done to effect a remedy? (3) How can a recurrence be avoided?

The evil appeared to arise from imperfect coating, due to the fact that the pipes must have been badly corroded before being coated; or the taste and smell of the water had possibly been accentuated, and its action upon the coating perhaps been accelerated, by the great heat prevailing at the time. Frequent tests were made with thermometers placed in the ground near the pipes, and in the water running from the hydrants; but they scarcely justified the acceptance of the latter theory. The firm who had supplied the pipes were unable to offer any explanation of the cause, especially in face of the fact that the pipes had been in use some considerable time. Their process of coating is thus explained in their own words:

We use the best ingredients to be had in the shape of coal tar and creosote oil. The usual proportion is about three parts of tar to one of oil, but that is not absolute. It has to be varied according to circumstances. The pipes were immersed in the solution at boiling-point, and retained in the boiling liquid for 20 to 30 minutes; thereafter being gradually withdrawn, in order that the solution would thin off and drain back and harden on the pipes. We are coating thousands of tons of pipes, and sending large lots to various towns in the North; and we have never had a complaint—not one—from any of these quarters that we remember, of the character we have received this morning.

They maintained that the pipes were quite clean when coated. They would not, in fact, admit any fault; and they declined to give a guarantee against any such fault occurring in future consignments. Inquiries addressed to other firms who had tendered for the pipes elicited the following reply from probably the largest pipe-founders in the country:—

We beg to say that the process we employ is that which has always gone under the head of Dr. Angus Smith's composition; and we never deviate from the specification. The pipes are heated to 300° in a stove, and then plunged into the composition, which is kept at boiling-point. We certainly should not give a guarantee that, under no circumstances, would water affect the coating, because we conceive it possible that there are waters whose qualities would affect this or any coating. But we are quite sure that in (say) 999 cases out of 1000 the water could not be affected. We have not recently received any complaints on this question; and the writer, who has been with this firm for more than 35 years, only remembers in the whole of his experience two cases, in both of which it was maintained that the defect was caused through certain qualities in the water, and wore off after the pipes had been flushed rather longer than it is usual to do.

One firm alone had received a similar complaint, although they had supplied many thousands of tons of pipes for water-works purposes. They must obviously have exercised extreme care in their coating processes, although the replies disclosed differences in practice by the various firms.

From a careful consideration of all the circumstances, little doubt remains but that, when the pipes in question were coated, they had become badly corroded; and to this cause may be ascribed most of the trouble experienced. Moreover, the defect in the coating is serious, because it will tend to materially reduce the life of the pipes.

As to whether the best means were taken to remedy the evil, is a question which must be judged in accordance with the circumstances and results together. The flushing appeared to have very trifling effect. It somewhat removed the taste from the water. Apparently, the real cure was only effected by getting rid of the objectionable coating, and by a lower temperature; but when it requires so long a period as 58 days, as in this case, it is a matter of serious importance.

Engineers are very much in the hands of the founders; it being frequently impossible, owing to the distance and time required, to attend at the foundry to inspect the whole process. In America the supervision is to a great extent done by "inspection companies," whose inspectors attend at the foundries on behalf of the water authorities to guarantee that the processes of casting and coating are properly carried out. Were there such firms here, whose integrity could be relied upon, and whose fees were reasonable, there might be a good field for their work.

There appears to be an indefiniteness about the exact constituents of Dr. Smith's composition, and the manner of applying it so as to properly and effectively coat pipes; and the author suggests that the best reliable data should be obtained by the Association, and a standard adopted and recommended for use by pipe-founders in order to obtain uniformity of practice.

The author then proceeded to give further experience with two additional lengths of pipes laid subsequently to the one referred to in the opening of the paper. In one of these there was trouble; and in the other there was not. As the circumstances were somewhat similar, the conclusion he came to was that in the two cases where there was trouble, an inferior coating had been applied to the pipes. He also quoted from certain authorities on the subject, and gave a *résumé* of what American engineers had done in experiment and research on this subject.

Concluding the paper, Mr. Humphreys said: Mr. Gandy, of the Staveley Iron Company, who has had considerable experience in this subject, has kindly promised to supply the author with sample pipes variously coated for experimental purposes, the results of which, if thought sufficiently interesting, may be placed before the Association at another meeting. In the meantime Mr. Gandy has supplied to the author, for purposes of testing, three 4-inch cups 6 inches deep—one coated with the solution as ordinarily used by his Company, the other two coated with blacksmith's varnish, applied hot in one case and cold in the other. Each was filled with water, and left standing at a temperature of 58° for 40 hours. A distinctly perceptible taste and smell occurred in the cup treated with blacksmith's varnish cold, while no smell or taste could be detected in the others. These trials have since been repeated with temperatures varying from 58° to 62°, but with the same result—in every case the coating remaining hard and brittle throughout.

Discussion.

The PRESIDENT (Mr. Frederick Griffith, of Leicester) thought the whole trouble experienced by Mr. Humphreys lay in a nutshell; and, in his view, such difficulty would be obviated if the constituents of Dr. Angus Smith's solution were adhered to. Even in large foundries, the question of the filling up of the cauldron containing the hot varnish was possibly left to one of the labourers; and he might not put in the substances in the proper proportion to give the necessary consistency to the coating of the pipes. He (the President) had had similar experience in regard to pipes; but the analyses proved that, though objectionable, there was nothing detrimental to health in the water.

Mr. F. J. BANCROFT (Hull) said this was a subject in which all members of the Association, whether in charge of large or small works, were interested. When they considered the large amount of money that was spent, and was always increasing, on the leading and distributing mains, it was seen that the proper coating of pipes in the first place was a matter of vital importance, because in most cases a pipe, when it was put into the ground, was generally not overhauled, and not seen again, until it was taken up and replaced. Mr. Humphreys had focussed the discussion in his three questions. There was one point he should like the author to tell them, and that was what was the consumption of water through the main in question. The case, to his (Mr. Bancroft's) mind seemed clear—that these pipes, according to the description, were stock pipes; there was no inspector on the works; and, when dipped, there were patches where the coating did not properly adhere. At first, there was very little trouble, because the coating was then intact; but as the water acted on the coating, it gradually removed the surfaces at the patches, and then attacked the iron, so that there was a taste of the coating in the water, and also a deposit of oxide of iron. He (Mr. Bancroft) had had little experience of such complaints. The only trouble had been at first (immediately after the pipes had been laid), and then the water had a slight taste which was always got rid of by flushing. He believed his theory was further borne out by the statement of Mr. Humphreys that he flushed the main by a large volume of water; and this caused a temporary cessation of the complaints. This would only be because he scoured off the loose coating; but it was not efficacious, as the coating, being gradually loosened in other places, caused further complaints. The water at York was a river supply, and would have acid properties. He should like to know whether any solvent action of the water was found generally upon the internal coating. He thought Mr. Humphreys' suggestion was a good one, that the Association should investigate this matter a little further, and find out, if they could, the best method of coating—whether the pipes should first be tested in water or in oil, and whether they should be dipped cold, or heated first and then dipped, because, if dipped cold, after being tested, rust would certainly have set in. Personally, he thought the trouble could be overcome if they adhered to the principle of having an inspector at the works and pay so much per ton to see

the pipes properly tested and coated. It would be a small expense on the total cost of the pipes; and it would repay the water-works, and at the same time relieve the engineer of a considerable amount of anxiety.

Mr. J. Molyneux (Stockport) asked the author whether the 3 feet was covered or was the depth of the trench. [Mr. Humphreys: The depth of the trench.] It appeared that the pipe was laid in very light subsoil; and it would be interesting to know the temperature of the subsoil, as it might have had something to do with the trouble. It would be noticed that the 6-inch main was laid in the cold weather; and it was not until summer that Mr. Humphreys had difficulty with the pipes.

Mr. J W. Lewis (Farnham) had no doubt the peeling of the coating was due to the composition not having been properly kept up; there was an excess of one thing or another. Then, when the temperature of the water and the ground rose, the coating peeled off. In his own case, he always went to one maker; and he never had the slightest trouble. Some years ago, before he took charge of his works, there was trouble repeatedly. This came from the use of tarred yarn. He did away with this, and used white hempen yarn; and they had had no difficulty since.

Mr. S. C. Chapman (Jersey) said only once in his experience had he come across a similar case to that quoted by the author. This was about 350 yards of 3-inch main; and it had only been down for a short time when they found the coating of the pipe was peeling off in patches about the size of a penny. At the same time there were considerable complaints as to disagreeable taste; but, by constantly flushing for a week or two, all the trouble was got rid of. Mr. Humphreys had referred to the question of the temperature of the water. Some years ago—about 1899—he took some temperatures of water at Plymouth, where he was assistant. In the reservoir, the surface temperature was about 69°; and 17 feet below the surface, it was 65½°. The water running in the brooks in the neighbourhood was about 58½°; and, although they were laying a considerable number of pipes at the time, they never had any complaint regarding the coating of the pipes, or as to any unpleasant taste from the water. At the present time, he was re-laying many miles of pipes; and he had never (except in the case referred to) had any complaint. What he was more interested in than anything else was the coating of the pipes on the outside. He was now removing pipes that had been down about 25 to 30 years; and he found them so corroded in many places that he could bore through them with a pen-knife. The whole of the pipes were plumbago-like. He had just had an analysis of the soil made; and he found that there was about 1·49 per cent. of sulphuric acid in it. Some of the pipes he had recently taken up were laid in 1895; and the coating inside had scarcely a mark on it, but the coating on the outside had quite disappeared in the majority of cases. If they could find something that would stand the action of the soil on the pipes outside, as well as a coating that would stand the wear and tear on the inside, they would be doing something of great advantage to everyone connected with water-works.

Mr. C. E. Jones (Leyton) questioned the desirability of continuing the testing of pipes by hydraulic pressure, which system gave opportunities for rust to form on the inside of the pipes. He thought it ought to be abandoned, and no water put into pipes until after they were dipped. Oil or air would be preferable to water for testing. He was decidedly of opinion that the life of pipes was materially prolonged by the application of Dr. Angus Smith's composition. He had no doubt at all that the case instanced by the author was due to use of improper material in the dipping-bath. Sometimes the makers ran short of material, and they employed—in fact, most of them employed—a proportion of gas tar. This tar was frequently associated with a lighter fluid (ammoniacal liquor), which contained free ammonia, and also some of the ammonia compounds in the fixed state. Whatever action took place in the bath between the tar and the ammonia was hardly known, unless they knew the temperature necessary to volatilize the liquor and some of the lighter oils. He took it that, if these pipes had any rust upon them at all, or had been tested by hydraulic pressure and exposed to the air, this would be very detrimental to their taking the heavier varnish on the iron. If dipped cold, too, they would undoubtedly be less capable of resisting the action upon the water afterwards than if heated first. He believed himself in heating pipes before they went into the bath, and not in putting them in the bath cold, and then bringing them up to the proper temperature. But, unless the material in the bath was of the proper temperature, and unless it was a homogeneous mixture (which was very difficult to make with the materials of different specific gravities which were employed in these baths), they could scarcely get a fluid of the same character, of the same consistency, or even of the same temperature right through the bulk. Besides which the process was generally left to men who were not specially trained in a knowledge of chemistry, or heat, or, probably, the constitution of the iron. They were employed to dip pipes, and they dipped them; and whether or not the coating firmly adhered and formed a polished surface upon the pipes did not interest the men who dipped them. He believed the author's trouble was due to the improper and inferior bath of coating into which the pipes were plunged. It was not at all an unusual thing, when pipes were freshly laid, and used to supply soft water, for there to be an unpleasant taste from the water.

Mr. W. Jones (Pontypridd) was fully persuaded that the *crux* of the whole question was in the manner in which the work of coating the pipes was carried out. He had recently examined the insides of pipes that had been laid for over thirty years; and he found them equal to what they were when laid down. He regarded the author's suggestion that they should have the work inspected at the foundry as a practical one. He thought the best plan was to apply the mixture to the pipes before they became cold; but the makers said it was not practicable—that they could not proceed with the process until they were satisfied that the pipe was intact. In South Wales, after the pipes were cast, they were sent to the stands, then tested, and the good pipes were stacked together. Then they were supposed to be reheated in stoves, and then dipped in Dr. Angus Smith's solution. He had sometimes received a complaint of the coldness of a pipe when it was dipped; and it appeared to him the remedy was to see that the work was properly carried out. Occasionally, he had an inspector at the works to see the operations performed, and then he (Mr. Jones) had little complaint as to any disagreeable taste. But sometimes pipes were ordered in a hurry (in times of drought), and then they suffered somewhat seriously.

Mr. W. L. Catlin (Lichfield) related an experience he had with 310 yards of pipes laid last January. There had been trouble with the water from these pipes, which were turned and bored. He found that rust was left in the pipes; and although they had been laid eleven months, the water had still a tarry taste.

Mr. J. Dewhirst mentioned an experience that he had had with some 5-inch mains. About 600 yards of these pipes he had in stock for eighteen months before they were used; and another portion he used almost direct from the foundry. Tests he had made showed that the water from the 600 yards of pipes that he had had in stock some time had (the coating having become so hardened) scarcely a perceptible taste; while the water from the 200 yards of new pipes direct from the foundry had a pronounced taste for three months or so after being laid.

Mr. E. A. B. Woodward (Wolverhampton) had had the same experience as Mr. Humphreys in the case of some small pipes he had had direct from the foundry. The nuisance of the water being tainted had continued for a considerable period, and the cause of the whole difficulty was the solution with which the coating was done. The makers knew perfectly well of what the solution should consist; that it ought to be properly mixed in the first place; and that it ought to be periodically stirred up, so as to give it a uniform character. The ingredients, of course, were of different specific gravities; and the question arose as to whether the boiling was sufficient to keep it uniform. In small pipes that were dipped vertically, they found the coating very patchy, and some parts were thicker than others.

Mr. C. Sainty (Windsor) was of opinion that the trouble often arose through water engineers having to get lengths of mains down in a hurry. The consequence was application was made to the foundry for a supply of pipes; and no sooner were they out of the cauldron, than they were put down—before they had a chance of getting thoroughly aërated, and had not got the taint of the tar out of them.

Mr. W. Ingham (Torquay) thought the specifications that water engineers made (which were founded on Dr. Angus Smith's rule) were not carried out in the foundries to-day. He believed that gas engineers had something to do with this, by abstracting some of the bye-products that Dr. Angus Smith intended should be left in the solution. Again, he had found that soft water, with a large amount of carbonic acid and a certain amount of free ammonia in it, would attack the coatings of the pipes under certain conditions—such as the temperature of the water. The question of heating the solution in which the pipes were dipped was also important. In some of the foundries, they were very lax over this point. It would be found that the best results came from foundries where they had false bottoms to their cauldrons, and the heat did not come direct on to the bottom of the tank containing the solution. Like most other engineers, he had had trouble. In 1897, he put down ¼-mile of 3-inch main, which was affected; and he had to take it out again. He used the pipes afterwards singly, or two or three together. Where the coating of pipes was at all dull, the tendency to cause taste in water would be found greater than where the coating was bright.

Mr. J. Shaw (Boston) said that, as far as he could see by the figures, there would be something like 30,000 gallons of water in the mains in question; and he should like to know whether that quantity of water would be got rid of in a day or part of a day. His own experience was that where there was a new main and a small consumption of water, especially soft water, there was almost invariably a taste. He had never come across a case where Dr. Augus Smith's composition was used in which, if there was a small consumption of water, the water did not taste, more especially in warm weather. Water from wells was of such a low temperature, and harder, that it did not cause an unpleasant taint so much as water from rivers.

Mr. F. A. Thompson, the Chairman of the Bolton Corporation Water-Works Committee, said (at a subsequent stage of the proceedings) that, looking at this question from the ratepayers' point of view, they paid for their water-pipes being properly coated; and if this was not done, the life of the pipes would be considerably shortened. He therefore thought the institution of inspectors to see that the work was properly carried out was the right course. He quite conceived that this was a class of work that would be given to men who did not appreciate its importance.

Mr. HUMPHREYS' reply to the discussion was necessarily, in view of the number of speakers, of some length; but it is here confined to the matters referred to in this summary. He emphasized the importance of the subject by pointing out that if a pipe was badly coated, it might only last ten years, while if it was coated in a proper solution it might last forty years. In proof of this, he mentioned that, only two weeks previously, he had taken up a broken main in a very old street in York. It was one of the old cone-socketed pipes; and, when taken up, the inside was absolutely intact, although it had been laid above 40 years. He might at once say that their own Analyst (who was the City and County Analyst), and other chemical people, said that the York water had no affinity whatever for the solution. He (Mr. Humphreys) thought the President struck the right note, when he said that, if the proper details of the composition were adhered to by the pipe makers, there would be no doubt that satisfactory results would be obtained. As to the consumption from the main in question, he might explain that it was laid in a great hurry for the benefit of the War Office, who had a large camp about six miles from York. But the war came; and they did not get so many men there as were expected. The result was that only a small quantity of water for the size of the pipes was used. He wished the members to bear in mind, however, that, from the time the pipes were laid, until a long period afterwards—for a matter of months—the water was all right. It was only when the temperature of the water increased, that they got this effect; and when water reached beyond a certain temperature, an inferior coating was a bad thing. The pipes were not stock pipes. They came from the foundry newly coated, and were newly laid. He had a section cut out from the first pipe laid. It was found that the coating was in patches; and he was afraid this was a sample of the whole main. If the coating of the pipes had remained intact, their life would very likely have been many more years, besides which, corrosion setting up, would probably diminish the size of the bore, and perhaps produce various other troubles. With reference to having an inspector at the works, he would have to be stationary to see the whole work carried through. The temperature of the subsoil was taken; but he was satisfied that this had nothing to do with the injury to the coating on the inside of the pipes. He agreed with Mr. Jones as to pipes not being tested until after they were dipped, and also with Mr. Dewhirst as to stocking pipes before using them. But the question was how long they could be stocked, because someone had to pay for them, and the money would be lying idle. He (Mr. Humphreys) was trying this now. He had on order 700 6-inch pipes, 12 feet long, and was going to stock them for six months so as to make assurance doubly sure. Mr. Ingham showed the importance and seriousness of this matter when he said he had laid a length of pipes, and had had to take them up again.

Mr. CHAPMAN (Jersey) gave a number of particulars which showed how great are the variations in water engineers' specifications as to coating, and yet all were supposed to be in accordance with Dr. Angus Smith's specification.

GAS ANALYSIS BY MEANS OF FLASKS.

In a recent number of the "Berichte," Herr A. Wohl had two communications on the above subject, the chief points in which have been given in the "Journal of the Society of Chemical Industry," from which the following particulars are taken.

In the first communication, the author dealt with the determination of a component of a gas by measuring the liquid required to displace it. Instead of the usual graduated gas burette and

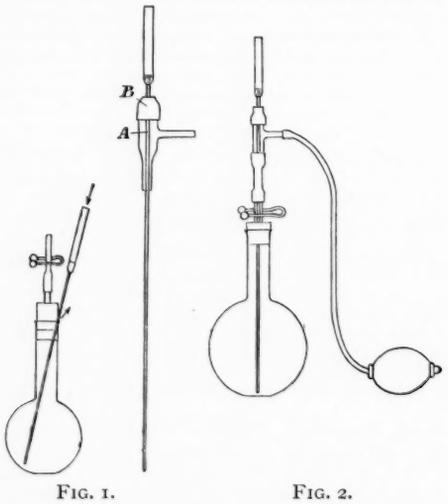


FIG. 1.

FIG. 2.

suitable absorbers, the author proposed the use of a single graduated glass flask for measuring off a known volume of the gas. After absorbing one of the constituents—*e.g.*, CO_2 or O_2—with the ordinary reagents, the decrease in volume is found by weighing or measuring the amount of water corresponding to the decrease. The accompanying figures show how the analysis is accomplished. Fig. 1 is a flask of 100 c.c. capacity, provided with a rubber stopper, short pieces of capillary glass and rubber tubing, and a pinch-cock. It is filled with the gas to be examined, by inserting a brass capillary tube nearly to the bottom, as shown in the illustration. After withdrawing the brass tube, the rubber stopper is pushed in until it reaches the 100 c.c. mark. This compresses the gas slightly. The flask is then placed for a quarter to half a minute in water at the temperature of the air, and the pinch-cock opened to allow the excess of gas to escape. In this way 100 c.c. of gas under the existing conditions of temperature and pressure are obtained.

An alternate and better method of filling is shown in fig. 2, in which the gas is sucked through the flask by the rubber bellows until all the air has been displaced. The absorbing reagent is introduced by a funnel of 40 to 50 c.c. capacity connected to the rubber tubing above the pinch-cock (see fig. 3). As soon as the absorption is complete, the funnel is filled up with water and the pinch-cock opened, in order to replace the absorbed gas by water. The original temperature is then recovered by placing the flask in water. At this stage the residual gas is under a slightly increased pressure, due to the column of water in the funnel and capillary tube. The original atmospheric pressure is attained by substituting a short piece of tubing (5 mm. diameter) for the funnel, and tilting the flask till the neck is filled with the liquid, as shown in fig. 4. On compressing the pinch-cock, some

FIG. 3.

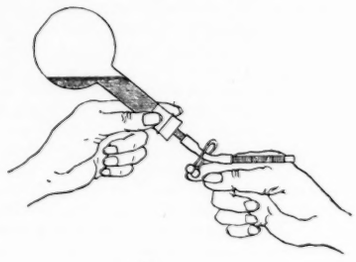
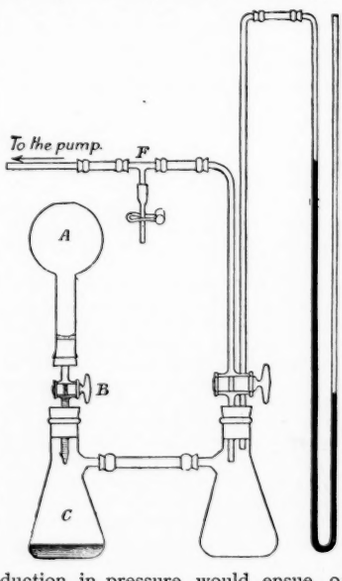


FIG. 4.

of the water flows out of the flask through the short tube, which is maintained in a horizontal position, as in fig. 4; and while the pinch-cock is fully open, the flask itself is also lowered into the horizontal position. The effect of this is that some of the water in the short horizontal tube flows back into the flask until the atmospheric pressure is restored. The pinch-cock is then shut, and the flask placed in the vertical position.

To determine the volume of the unabsorbed gas, the stopper is removed and the flask filled up to the mark with water from a burette. Or, by weighing the flask before and after the absorption, the volume of absorbed gas may be ascertained. For very accurate work, corrections must, of course, be made for the specific gravity and the vapour pressure of the absorbing reagent admitted to the flask. For the approximate estimation of carbon dioxide in gases in the works, the author recommends the use of a larger flask—viz., one of 200 to 400 c.c. capacity.

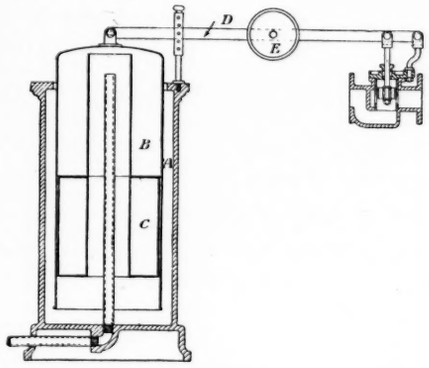
In the second communication, Herr Wohl dealt with the determination of a component of a gas from pressure measurements. The operations of filling, absorbing, &c., are in general similar to those already described up to the point at which the volume of the residual gas is to be determined. The flask A B is then attached to the apparatus shown in the accompanying diagram. By carefully manipulating the taps, the pressure in the apparatus is reduced to such an extent that the residual gas contained in A is expanded down to the bore of the stopcock B, the portion of the tube below B remaining filled with expelled liquid when B is fully opened. The pressure is then read on the manometer. To facilitate the fine adjustments necessary, the author files notches in the keys of the stopcocks. In estimating oxygen, C must be half filled with water containing sufficient acid to neutralize the alkaline pyrogallol, otherwise a reduction in pressure would ensue, owing to the absorption of oxygen from the air contained in C on discharging the reagent from A.



REGISTER OF PATENTS.

Governor to Regulate the Speed of an Engine to Suit the Varying Make of Gas.—Waller, G., of Queen Victoria Street, E.C. No. 22,379; Nov. 6, 1901.

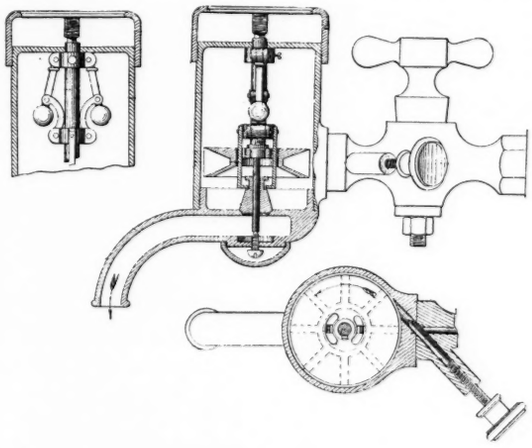
This apparatus consists of a tank which contains a metal cylinder open at the bottom, and with a circular air chamber or float, varying in size to suit the vacuum required. On top of the cylinder is a joint attached to one end of a lever, and the other end to an equilibrium steam-valve, which increases or decreases the amount of steam to suit the varying make of gas.



In the vertical section of the governor shown, the tank A contains a bell B, with float C, which rises and falls with the pressure or vacuum of the gas, and thus moves a lever D operating and regulating the equilibrium steam-valve, as shown attached to the steam-engine. A weight E on the lever D is moveable to adjust the working of the valve.

Liquid-Meters—Mills, B. J. B.; a communication from S. Bouchet, of Tassin, France. No. 23,272; Nov. 18, 1901.

This invention relates to the class of meters in which the delivery is indicated by the number of revolutions of a turbine traversed by the liquid to be measured. It is characterized by the application to the axle of the turbine of a centrifugal regulator acting upon a valve of special form, which more or less opens the discharge-orifice according as the delivery is greater or less. The claims made on the part of the patentee for the arrangements shown are: (1) In a liquid-meter of the turbine class, the application of a regulator revolving with the turbine and operating a valve which opens the discharge-orifice in proportion to the quantity delivered, and which at rest completely closes the orifice—the putting in motion of the turbine on the opening of the cock, before raising the valve, being permitted by the compression of air in the turbine-chamber combined with the lost motion between the regulator connections and the valve. (2) The combination with a cock of any suitable character, of a closed chamber containing the turbine, a centrifugal regulator mounted on, and rotating with, the turbine-shaft, a valve operated by connections from the ring of the regulator, a play (or lost motion) between the connections from the regulator-ring and the valve, an opening forming a seat for the valve and communicating with the delivery spout, means for regulating the height of the turbine-shaft, a passage delivering the liquid from the outlet of the cock to the turbine tangentially to the latter, and a screwed pointed rod controlling the cock-outlet.



Gas Cleaning and Cooling Apparatus.—Crossley, W. J., of Manchester, and Atkinson, J., of Marple. No. 24,960; Dec. 7, 1901.

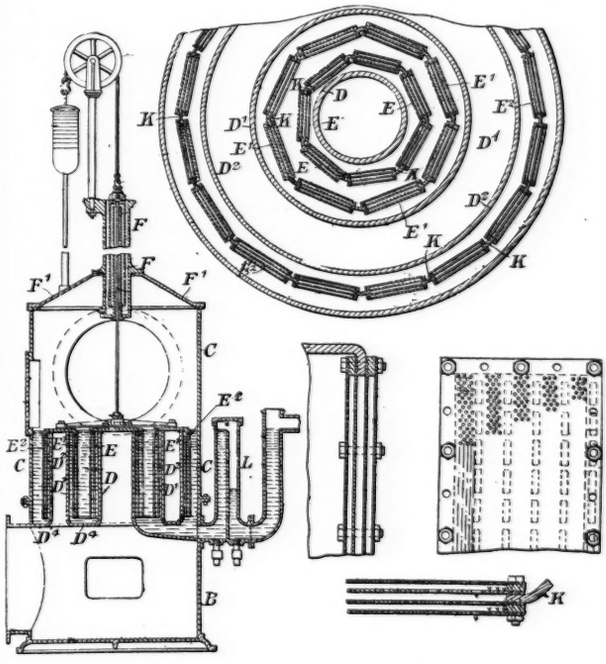
This invention is more particularly adapted to the cleaning and cooling of blast-furnace and producer gases. The patentees provide an arrangement of cooling towers and tanks in sections—a supply of cooling water passing through the rotary cleaners, where it will be of the "greatest assistance" in finally reducing the gas to the lowest possible temperature; flowing from them into the coldest tank; and being circulated from this tank into, or on to, towers in this tank. The overflow then passes to the next tank (where it may be used at a higher temperature) and to another tower or series of towers in a similar manner; and so on, if desirable, to a third or more sections of tanks and towers.

Lighting and Extinguishing Gas-Lamps from a Distance.—Stoltenhoff, H., of Cologne. No. 25,013; Dec. 7, 1901.

This device for operating gas-lamps consists essentially of electro-magnets arranged in such a manner that the various parts of the mechanism are not exposed to the current of gas, and so are not liable to be injured thereby. There is a rotary drum, provided with slots adapted to make hit-and-miss connection between the main gas supply and the burner; and means are furnished for rotating the drum by the action of an electric current.

Tar-Extractor.—Holmes, E. D.; a communication from O. N. Guldlin, of Fort Wayne, Ind., U.S.A. No. 25,493; Dec. 13, 1901.

In this apparatus for extracting tar from illuminating gas, numerous small streams of gas are made to impinge against impact surfaces—thereby rupturing the tarry globules, and liberating the contained gas and hydrocarbon illuminants, while the tar is arrested. Heretofore, apparatus of the Pelouze and Audouin type has been made with a single regulating drum, having perforated cylinders or plates, for causing the small streams of gas to strike against impact surfaces so as to rupture the tar globules; but as such construction is said to be inadequate and not economical for apparatus of large capacity, the present inventor constructs the apparatus with two concentric tar-cups and gas-passages, which enable three concentric drums having perforated plates to be employed—affording a greatly increased area of perforations and of impact surfaces in a given space, and "obtaining corresponding economical and effective results."



The illustrations show a vertical section of the apparatus, a horizontal section through the shell, concentric cups, and perforated tar-extracting drums, and details of perforated plates, &c.

The casing of the apparatus is constructed of three sections—the base B, the middle section C, containing the concentric sealing-cups and the compound-regulating drum, and the sealing-tube F. The section B is preferably cast with the cylindrical concentric walls D, D^1, D^2, rising above the gas-inlet chamber and forming gas-passages open at the top and bottom, and annular tar-cups with bottom plates D^4. The cups have bottom openings leading into the tar-outlet pocket (extending to the outer wall of the section, where the overflow trap is connected), made with an inclined bottom, so that all heavy matter may freely flow off. The section C is provided with the gas-outlet pipe, and is closed at top by the seal-tube F and the cap F^1.

The compound regulating and tar-extracting drum is composed of two outer concentric walls E^1 E^2, adapted to dip into the annular tar-cups. In addition to the compound drum, there can be provided the usual central drum E, having a head around the central inlet. The drums are made of polygonal shape—built up of sections or frames containing flat perforated plates, and of connecting corner-posts for facilitating construction and repair of the parts. Each drum or wall of a drum is constructed of angular corner-posts K, and sections or frames containing flat perforated plates. Each frame is constructed of end-bars and side-bars; and two plates are secured to opposite sides of the bars or frame. Two such frames are secured to the opposite sides of the corner-posts K. Each injecting plate is made with vertical rows of injecting perforations and intermediate blank surfaces. Each of the impact-plates is made with vertical blank impact-surfaces and intermediate rows of large slots or openings for the free escape of gas. The plates are, of course, so assembled in the frames that the injecting

perforations are opposite blank impact-surfaces. The space between two frames is greater than that between the plates in one frame, so as to allow the gas to gather force or pressure to be injected through the perforations and impinge with proper force against the blank impact-surface of the next plate.

In order to prevent the accumulation of heavy tar in the bottom of the seal-cups, there are the bottom openings into the drain-pocket below the cups cast to the shell or outer wall of the apparatus, which has an opening for the discharge of tar. An overflow-trap L connects at this opening with the shell. It has a vertical central partition rising from its bottom to near its top, and to the height at which it is desired to maintain the tar-level in the seal-cups. An outlet tar-pipe connects with the lower end of the trap, and rises to about the height of it, where a branch connects, leading to a seal-pot. An equalizing gas-pipe connects with the top of the trap L, and with the main gas-inlet pipe, for equalizing the pressure on the tar in the trap and on that in the seal-cups.

The counter-balanced drum E and the compound drum composed of inner and outer concentric walls E^1 E^2, act as regulators for treating variable volumes of gas to extract the tar therefrom. If an increased volume of gas is being generated and passed into the apparatus, it will exert an increased pressure on the drums, causing them to rise farther out of the sealing liquid in the cups, and expose an increased area of perforations for passage of the gas. When the volume of gas decreases —resulting in decreased pressure – the drums descend deeper into the sealing liquid, thereby decreasing the area of exposed perforations in the walls of the drums. The pressure of gas therefore remains substantially the same in the drums, and it is consequently forced or injected in small streams under uniform pressure through the perforations and caused to impinge against the impact-surfaces, so as to rupture the tar globules, liberate volatile illuminants, and arrest the tar.

Retort Discharging Apparatus.—Wise, W. L. ; a communication from the Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz. No. 368 ; Jan. 6, 1902.

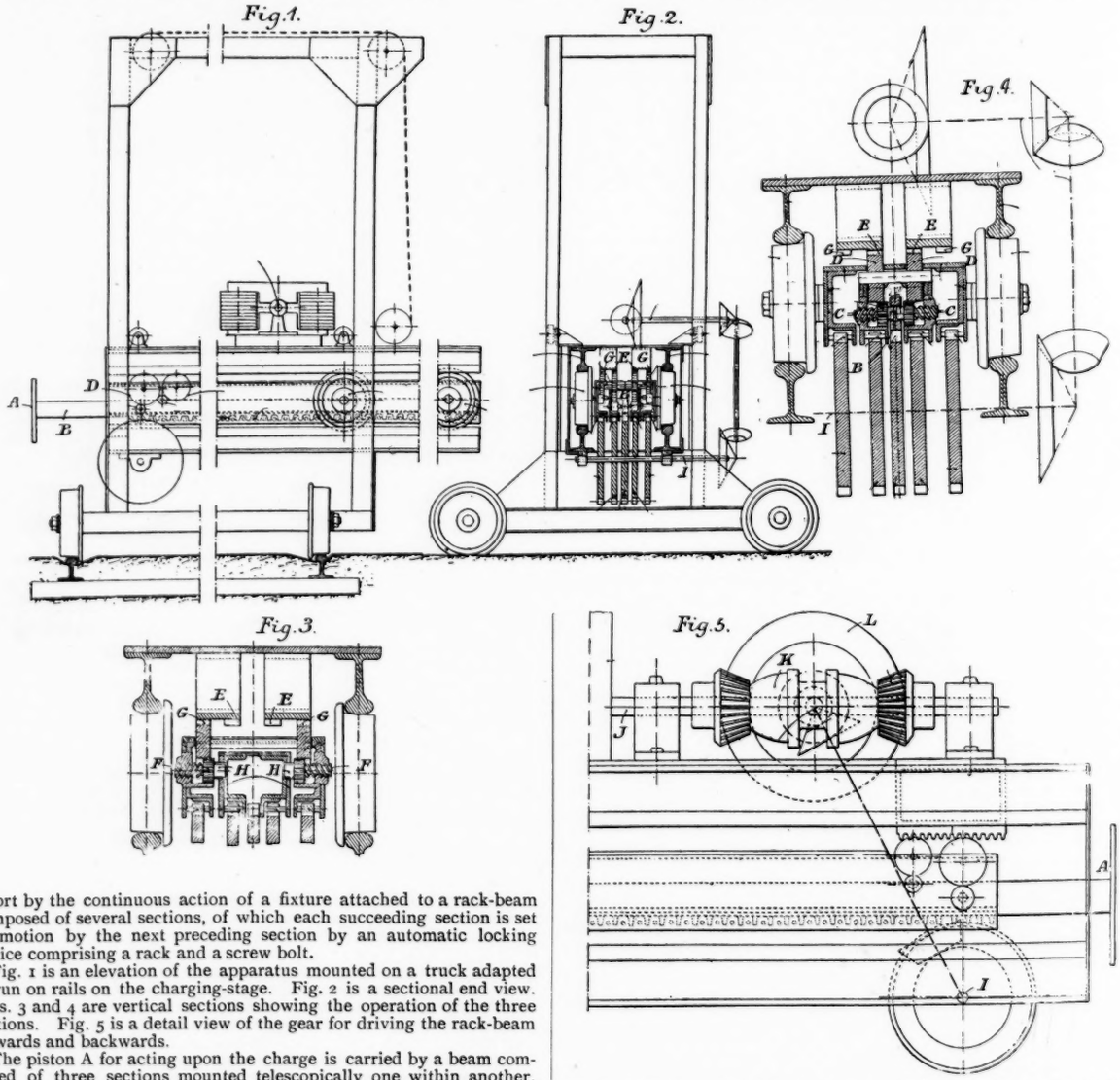
This apparatus is adapted to discharge the coke rapidly from a long retort by the continuous action of a fixture attached to a rack-beam composed of several sections, of which each succeeding section is set in motion by the next preceding section by an automatic locking device comprising a rack and a screw bolt.

Fig. 1 is an elevation of the apparatus mounted on a truck adapted to run on rails on the charging-stage. Fig. 2 is a sectional end view. Figs. 3 and 4 are vertical sections showing the operation of the three sections. Fig. 5 is a detail view of the gear for driving the rack-beam forwards and backwards.

The piston A for acting upon the charge is carried by a beam composed of three sections mounted telescopically one within another, and moved in succession. The inmost section B is an iron bar placed on edge, and furnished at its lower portion with a rack. The two other sections of the compound beam are constructed of channel iron, flat bars, and angle-irons, so as to form two large inverted channel-beams, each of which is furnished at its lower portion with a pair of racks. In the two flanges of the inner channel-beam or middle section are fixed square-threaded screws C, of which one has a right-hand and the other a left-hand thread, and on which fit nut pinions in engagement with toothed wheels D that engage with racks E fixed to the frame of the apparatus, which is mounted on a truck adapted to run on rails on the charging-stage of the retorts. The nut pinions are provided with bosses or projections opposite to which recesses are formed in the inmost section of the beam. This is a locking device to be explained later. A similar locking device, comprising screws F, toothed wheels, racks G, bosses or projections H, and recesses, opposite to the bosses or projections, in the flanges of the middle section, enable the middle and outmost sections to be connected rigidly together.

The successive movements of the three sections are effected in the following manner : An electric motor drives, through reversible transmission gear, an operating shaft I, carrying five toothed wheels so arranged that the middle wheel is opposite to the rack of the inmost section, the two wheels adjacent to it are opposite to the racks of the middle section, and the other two wheels opposite to the racks of the outmost section. Before discharging the retorts, the three sections are telescoped, so as to reduce the length of the compound beam to a minimum. The rack of the inmost section is now in engagement with the corresponding wheel on the operating shaft ; but the racks of the other two sections are not in engagement with their corresponding wheels. When the apparatus is set in motion, the inmost section is moved by the operation of its rack ; and when its rear portion comes opposite the front edge of the middle section, an arrangement of abutments causes the middle section to be moved by the inmost section. During this movement, the pinions D carried by the middle section and engaging in the fixed racks E are thereby rotated, and cause the corresponding pinions to move along the corresponding screws C and insert their projections into the inmost section, which is thus locked to the middle section. At the same time, the movement of the middle section causes its racks to engage with the corresponding wheels of the operating shaft ; the rack of the inmost section leaving the corresponding wheel. From this moment, the movement of the inmost and middle sections is effected by the pair of wheels and rack of the middle section ; the inmost section being moved forward by means of the corresponding locking device.

When the middle section is in turn almost fully extended, it mov s



the outmost section for an instant by means of abutments. During this time, the other sections are locked by the bosses or projections H of the corresponding locking device; the wheels on the operating shaft and corresponding to the outmost section are brought into engagement with the racks thereof; and at the same time the racks of the middle section are disengaged. The three sections are then moved by means of the outmost section. The operations described are reversed to return the piston.

In one example of suitable transmission gear (shown in detail in fig. 5), the motor K drives a shaft J on which slides a friction clutch, which is caused to rotate with the shaft by means of a key. According as it is moved in one direction or the other, the clutch engages with one or other of two bevel pinions loosely mounted on the driving shaft and engaging in diametrically opposite portions of a wheel L that is keyed on a shaft connected with the operating shaft I, so that the operating shaft can be driven in either direction as described.

Quenching Coke.—Wise, W. L.; a communication from the Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz. No. 586; Jan. 8, 1902.

According to this invention, coke is quenched by a short immersion in water so as to leave in the cooled coke only a predetermined quantity of water, which may be less than 1 per cent. The immersion may be effected in various ways according to circumstances. The coke may be delivered so as to fall directly from the retort into a water-tank, and remain under the water for a few seconds, after which it may be removed by suitable apparatus having blades or buckets, or the red-hot coke may be caused to fall in a cage suspended in such a way as to subject the coke to a short immersion in the water. Fig. 1 shows the quenching apparatus complete, having a coke-conveyor mounted

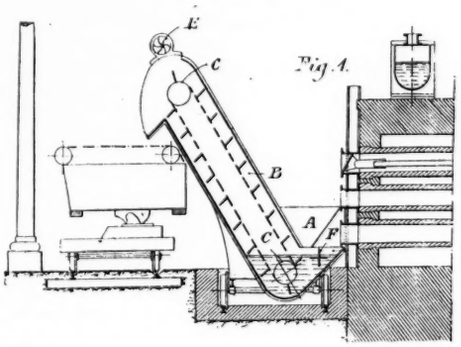


Fig. 1.

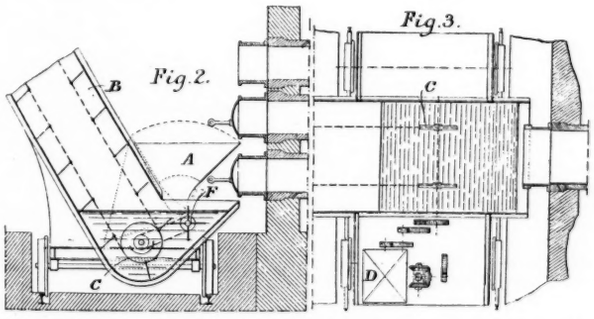


Fig. 2.

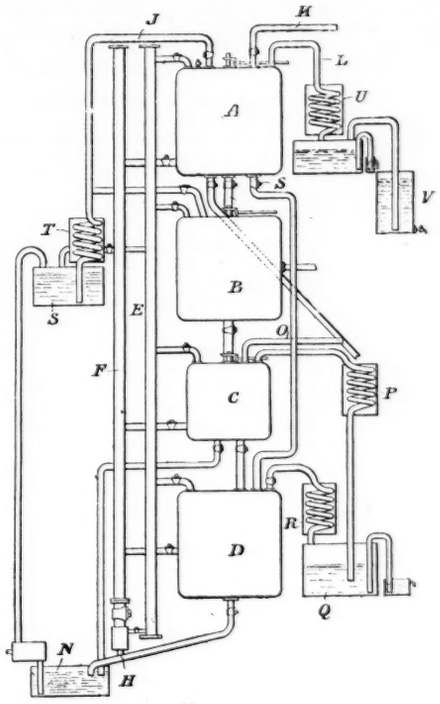
Fig. 3.

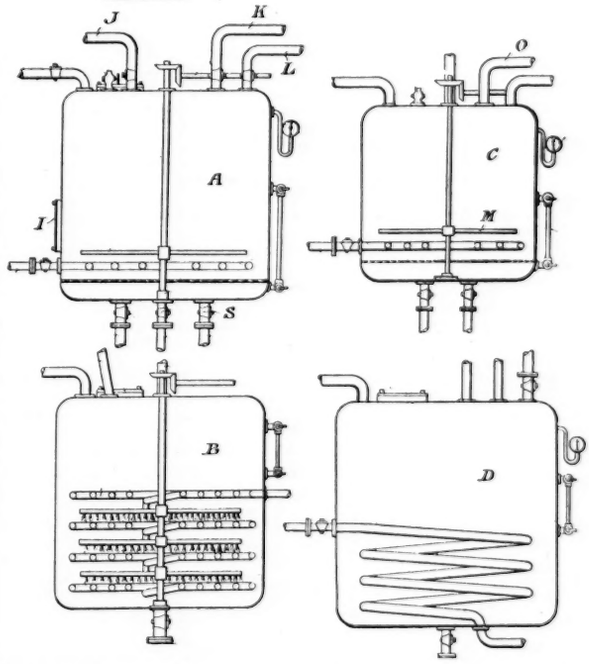
on the drawing stage on the right-hand side of a retort. In this figure, the tool of the discharging machine is shown in one of the retorts of the upmost row. Fig. 2 is a detail view (to a larger scale) of the lower portion of the apparatus. Fig. 3 is a plan corresponding to fig. 2. The coke on leaving the retort falls into a hopper A hinged to a casing, whose lower portion forms a water-tank. Through the bottom of the hopper the coke passes into the water-tank, in which is a bucket or blade elector B mounted on a carriage which runs on rails in front of the retorts. The chain of buckets or blades passes over two pairs of pulleys C, whose axles are operated by a motor D, and raises the coke to an incline, whence it falls into a truck after being quenched by its rapid and momentary immersion in the water-tank. The steam produced by the immersion of the coke may be withdrawn by means of a ventilating fan E in the upper part of the casing. In order to compel the last pieces of coke to pass through the water so as to be quenched before they are conveyed away, there may be mounted in the casing and below the hopper A a paddle-wheel F, in gear with the conveyor, so as to feed the coke thereto.

Desulphurization of Sulphurous Substances, and the Treatment of the Spent Substances in the Purification of Gas.—Maybluh, C. F., of Levallois Perret, France. No. 4646; Feb. 24, 1902. Date claimed under International Convention, Sept. 25, 1901.

The processes now in use for dissolving sulphur have the serious defect (says the patentee), especially where they are applied to the treatment of the materials used for the purification of gas—Laming mixture or spent oxide—of dissolving the tarry substances which remain mingled with the sulphur after evaporation of the solvent, and cannot afterwards be separated from it.

The present invention relates to a process in which the dissolving of the sulphur takes place by means of hot petroleum or similar mineral oils, the boiling point of which is higher than 150°C. These substances having a very slight solvent power when cold, allow the sulphur to precipitate on cooling. The temperature at which the operation takes place should be from 135° to 150°. Almost pure sulphur is thus obtained, which simple distillation will render merchantable. The removal of the petroleum remaining in the desulphurized oxide and the precipitated sulphur is effected by means of benzene, the separation of which from the petroleum may easily be obtained by simple distillation at 100°. It is true (the inventor remarks) that the benzene dissolves a little sulphur at the ordinary temperature; but this is recovered in the residue from the distillation where it is precipitated. The petroleum, and also the benzene separated, can be used over again in succeeding operations. In the special treatment of the spent oxides from the purification of gas, it is preferable to desulphurize them before attempting to extract the ferrocyanides, as they can then





be treated with the aid of heat without fear of forming sulphocyanides. The ammonia, which it is often difficult to collect by the ordinary processes, can be thus collected easily and without appreciable cost.

The advantages of the process are said to be the following: Whereas in processes now in use for the treatment of the spent oxides from gas purification, only the ferrocyanides and sometimes the ammonia are recovered in the form of useful residuals, the sulphur being wasted, with this process the ferrocyanides are obtained as usual, all the ammonia in every case, and the sulphur in a merchantable state. Moreover, the process is much more rapid than the usual ones, and the residual substances become inoffensive, and may even be utilized as material for again preparing a purifying mixture. A form of the apparatus is illustrated; also the separate vessels in which the operation takes place.

The apparatus consists essentially of the desulphurizing tank A, the refrigerating tank B, the filter tank C, and the separating tank D. All the tanks are connected to a main vacuum pipe E; and the tanks A, C, D are further connected to a main steam-pipe F. To the steam-pipe is attached a Körting ejector G, to which a pipe leads from the main vacuum pipe H. If the ejector is in action, the steam blows out by the pipe, and a vacuum is produced in the pipe.

The substances to be desulphurized are charged with the petroleum into the boiler A, provided with a double filter bottom, and a coil steam-pipe connected to the main steam-pipe. By heating the petroleum at 135° to 150° C. by the coil, the sulphur contained in the spent oxide is dissolved. The substances to be treated are filled in through the manhole I; the petroleum enters through the pipe J; and the water through the pipe K if desired for cleansing. For stirring up the contents of the tank, an agitator driven by a shaft is employed. On the bottom of the tank are fastened three cocks; the first leading to the tank B, the second to the tank D, and the third to the open air. On the cover are further provided an air-cock and a pipe L, which will be later described.

When the solution of the sulphur in the tank A has taken place, the petroleum is run off into the refrigerating tank B, in which the solvent is cooled by cold water circulating in the coil shown. A revolving agitator provided with brushes prevents the deposit of sulphur on the coil. The refrigerating tank is also furnished with a manhole and a pipe leading to the main vacuum pipe E.

The cooled product is then run off out of the tank B into the filter tank C, which also has a double filter bottom on which the separation of the sulphur from the petroleum takes place. The tank is also provided with an agitator M, and an air-cock—a steam coil-pipe connected to the main steam-pipe F and a pipe leading to the main vacuum pipe E. On the top part are further provided a water-inlet and a pipe which will be later described. From the bottom a pipe leads to the petroleum vessel N, and another pipe to the separating tank D. The operations described are repeated under the same conditions until the sulphur is completely dissolved out.

In order to remove the petroleum impregnating the separated sulphur in the tank C, benzene is added, which dissolves the petroleum. By opening the cock leading to the main vacuum pipe E, the benzene is drawn into the filter tank C. By this means, the whole of the petroleum is dissolved in the benzene; the latter being then conveyed to the separating tank D. For removing the last benzene residues from the sulphur precipitated in the tank C, water is added by the tube O; and the whole mass heated by a steam-coil. The benzene evaporates; and its vapours are condensed in the coiled pipe enclosed by a vessel P containing cold water. The condensed benzene is collected in the benzene vessel Q. The benzene containing the petroleum is run off, as already stated, into the separating tank, which is also provided with a steam coil-pipe. A tube leads from the top part to the desulphurizing tank; and another tube, having a coiled part enclosed in a cold-water vessel R, leads to the benzene vessel. The latter is connected through a syphon to a safety vessel, for regulating the escape of the water of condensation.

The contents of the tank D are then heated to 100° C., by passing steam through the coil; the benzene being evaporated, and condensed again in the coil of the vessel. After this separation, the petroleum is run off into the vessel connected with a pump N, which may pump the petroleum into an upper vessel S. This upper petroleum vessel is further connected to the main vacuum pipe and to the tanks A and B by pipes containing a coiled part enclosed in a cold-water vessel T.

The desulphurized oxides contained in the tank A have first benzene added for dissolving the petroleum. The benzene is contained in a vessel provided, like the vessel Q, with a syphon, and a safety vessel for regulating the escape of the water of condensation. From the benzene vessel a tube leads, with a coiled part enclosed in a cold-water vessel U, to the top of the tank A, and another tube to a further vessel V. After having dissolved the petroleum, the benzene is run off out of the tank A through to the tank D, where the separation takes place in the manner already described.

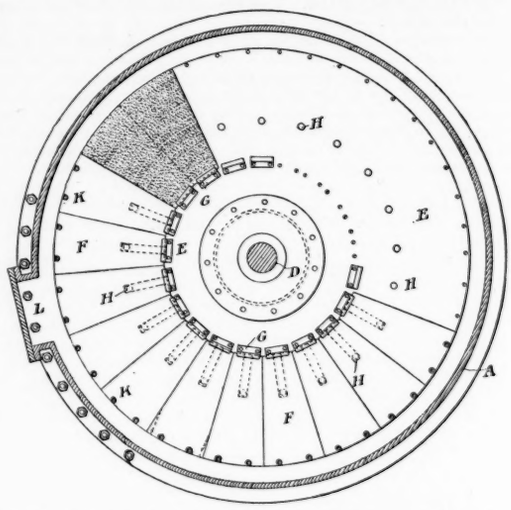
The desulphurized oxides, still charged with benzene have then a suitable quantity of lime and water added to them; and they are brought to the boiling point. The benzene and the ammonia contained in the mass are distilled off; the benzene vapours are condensed in the coil of the vessel U; and the benzene is collected while the ammoniacal gas passes further into the vessel V, where it dissolves or combines with an acid according to the state in which it is required. The ferrocyanides contained in the mass combine with the lime added and form ferrocyanides of calcium. The latter may be separated from the desulphurized oxides in special vessels, where the usual treatment for converting them into ferrocyanide of sodium or pottassium takes place.

By opening the respective cocks leading to the main vacuum pipe E, and those leading to the petroleum or benzene vessels, an easy filling of the tanks with the required liquid is obtained.

Washing and Scrubbing Gases.—Holmes, P. F. & E. D., and Cameron, E. G., of Huddersfield. No. 7364; March 26, 1902.

In this apparatus for washing and scrubbing gases, brushes mounted on revolving metal discs are partly immersed in washing liquid within a cylindrical casing, and made to revolve in contact with transverse partitions of the casing, while the gases to be washed or scrubbed pass transversely through the brushes so as to be brought intimately in contact with the washing liquid taken up thereby. The brushes are formed in segments with their backs secured to the revolving discs by screws. Up to the present time, it has been necessary, when the brushes became clogged or otherwise defective, to dismount the apparatus in order to gain access to the screws for enabling the brush-segments to be removed—as in P. F. Holmes's patent No. 5113 of 1895. The present invention, however, has for its object to enable the brush-segements to be removed and replaced by new ones without requiring in any way to dismount the apparatus.

As shown, the casing A, with its partitions B C, and shaft D, carrying discs E, to which the brush-segments F are attached, is constructed in the usual way. But, according to the present invention, the brush-segments are secured to the discs by providing upon the latter, at a distance from the centre corresponding to the inner end of the brush-segments, a series of brackets G in number corresponding with the number of segments employed. These brackets are adapted to receive the inner ends of the segments F, and to hold them securely.



When the apparatus is of large dimensions, the segments are further secured in position by providing disc-headed studs H; while on the back of the brush-segments are formed radial under-cut grooves I, preferably made by fixing a metal strip J on each side of the groove I cut in the wood back, so as to overhang. Thus, on sliding the brush-segments radially inwards, the studs H engage with the grooves I, and the inner end of the segment engages with the bracket G—thus attaching the segment to the disc E in the required position. The segments are then secured against shifting outwards by screw-bolts K passed through the brush backs and through holes in the disc.

APPLICATIONS FOR LETTERS PATENT.

25,760.—Parkinson and W. & B. Cowan, Ltd., and Chubb, A. G., "Lighting attachments for gas-burners." Nov. 24.

25,802.—Varley, F. H., "Incandescent gas and oil-vapour burners." Nov. 24.

25,853.—Haddan, R., "A new gaseous fuel." A communication from A. Riu Nov. 24.

25,855.—Maréchal, M. L. E., Barrière, P. F. V., and Gaillot, F. L., "Gas-generators." Nov. 24.

25,870.—Wright, J. W. B, and Darwin, H., "Gas heating-stoves." Nov. 25.

25,949.—Gillard, T., "Gas brackets." Nov. 25.

25,958.—Lake, H. H., "Testing illuminating gas." A communication from Gasmesserfabrik Mainz Elster and Co. Nov. 25.

25,986.—Sharp, J., "Fluid Meters." Nov. 26.

26,035.—Carolan, E. A., "Photometers." A communication from the General Electric Company. Nov. 26.

26,121.—Gibbons, W. P. & G. B. A., "Conveyors for hot coke, ashes, or other materials." Nov. 27.

26,195.—Schill, C. H., and Lane, H., "Purification of gas." Nov. 28.

26,228.—Mackellar, W. C., and Mackenzie, T., "Conveyors." Nov. 28.

26,236.—Schulthess, C. O., "Chandeliers, brackets, or the like." Nov. 28.

26,249.—Mockett, M., "Gas-stoves." Nov. 28.

26,310.—Chester, G. & T., "Rotary engines, pumps, blowers, and exhausters." Nov. 29.

26,324.—Gregson, T., "Incandescent gas and like lamps." Nov. 29.

26,327.—Foxall, J., "Automatic prepayment gas-meters." Nov. 29.

26,389.—Schütze, P., "Exhausting gases." Nov. 29.

26,409.—Pearson, J. T., "Lighting streets with electricity, gas, and other illuminants." Dec. 1.

26,492.—Jepson, R. L., and Johnson, G., "Incandescent mantle preserver." Dec. 2.

26,591.—Baedeker, E., "Lamps or lanterns." A communication from E. J. Arnold. Dec. 2.

26,694.—Down, H. L., "Controlling and lighting gas-burners." A communication from C. Franzen. Dec. 3.

26,705.—Scott-Snell, C., "Anti-vibrators for incandescent gas lighting." Dec. 3.

26,709.—Wilson, A., "Gas-producers." Dec. 3.

26,769.—Holmes, E. D., "Manufacture of carburetted water gas." A communication from O. N. Guldlin. Dec. 4.

26,845.—Naisbitt, W. J., "Protecting and preserving incandescent mantles." Dec. 5.

26,855.—Kühn, G. S. H., "Manufacture of incandescent mantles." Dec. 5.

26,869.—Abel, C. D., "Controlling the admission valve of an internal combustion engine." A communication from Gasmotoren Fabrik Deutz. Dec. 5.

26,907.—Schofield, A., "Coin-freed gas-meters." Dec. 6.

26,912.—The Griffiths and Browett (1901) Company, Limited, and Chandler, F., "Gas grilling and boiling stoves." Dec. 6.

26,955.—Bachner, A., "Incandescent gas-burners." Dec. 6.

26,964.—Melckebeke, R. van, "Gas-stoves." Dec. 6.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Testing of London Gas.

SIR,—In your notice of the alterations in the "Notification" issued by the Gas Referees for the year 1903, you are slightly in error—although there is some excuse for the mistake—in stating that three (possibly four) chimneys may have to be used to meet the requirements of testing the gas supplied by the three London Companies.

The chimney that must be used for the Gaslight and Coke Company's gas is a 6 inch by $1\frac{7}{8}$ inch internal diameter—commonly called "6 by 2." For the South Metropolitan gas, a 6 inch by $1\frac{5}{8}$ inch internal diameter must be used. This is commonly called a "6 by $1\frac{3}{4}$;" and it is so mentioned in the "Notification" above referred to. But no mention is made as to whether the diameter is of external or internal dimension. Hence your error. External is here meant, since a $1\frac{3}{4}$ inch internal diameter chimney cannot possibly be placed on the "London" argand burner. The Commercial Company's gas will be tested with the same sized chimney—*i.e.*, 6 inch by $1\frac{3}{4}$ inch external diameter or 6 inch by $1\frac{5}{8}$ inch internal diameter.

You will now readily see that only two chimneys of different diameters, but of the same length, are prescribed. I merely draw your attention to this matter, as others may interpret the wording of the "Notification" wrongly.

W. GRAFTON.

East Ham, Dec. 13, 1902.

Gas Companies "Inspectresses."

SIR,—In connection with your article of the 9th inst.—*re* inspectresses—may I advocate a modification of the Californian plan which may be more feasible. Some three years ago, I made a suggestion to one of the London Gas Companies that inspectresses or lady advisers should be engaged to deal with cases of complaint. I understood that, on receipt of a complaint as to the performance of a cooking-stove, the ordinary course is to send an inspector or a fitter to examine and report upon the stove fixing; whereas, in the majority of cases, the complaint really arises from the consumer's ignorance of the correct method of using the stove.

I regret to say my suggestion was not favourably received; but, although I admit that considerable discrimination would be necessary in selecting the inspectresses, and that their duties would call for some tact, I still think that the glad housewife, who has realized the applicability of gas to all kinds of cooking and its superiority to coal-fires, would influence her friends in its favour far more effectively than any trade or company advertisements.

I have recently learned that a large Suburban Company are doing something in the direction indicated; and I venture to hope that their action, and the suggestion as above of the modified Californian plan, may lead to a further development of the idea.

A. CLEVERLY.

182, *Brecknock Road, N., Dec.* 11, 1902.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Monday, Dec. 8.

LONDON WATER (RECOMMITTED) BILL.

To-day the House resumed the consideration of this Bill in Committee—Mr. A. P. JEFFREYS in the chair.

On clause 5, dealing with the discharge, application, and distribution of compensation, an amendment was carried by which the word "compensation" was omitted, and the words "money or stock" were substituted. Several consequential and drafting amendments having been agreed to, the clause was added to the Bill.

Clause 6, which deals with the application of sinking funds, was also passed.

On clause 7, bearing upon the substitution of water stock for irredeemable debenture stock,

Mr. FLETCHER MOULTON moved an amendment to enable the purchasing authority to acquire the irredeemable stock. He said his amendment was in accordance with the universal practice of Parliament when granting a public authority the right to purchase private property compulsorily. The purchasing authority was always given the right absolutely to extinguish all interests in the property it took, paying an equivalent in money. What he proposed was, that the Arbitrator should fix what the value of the stock was with a fair allowance for the expense of reinvestment, and the Water Board, when the value was fixed, should be allowed to buy out the whole interest. In other words, he asked that the Board should be treated as every other purchaser of property for public purposes had been treated up to the present time.

Sir F. BANBURY said the amendment, if carried, would give to the debenture holders more than they would receive under the Bill. He hoped the Government would adhere to their proposal.

Mr. BUXTON argued that the proposal of the Government would involve the loss to the ratepayers of a capital sum of £200,000 or £300,000.

Mr. LONG said he was convinced that the course proposed by the Government was the best. Experts were not agreed; but it was clear that, if the amendment were adopted, no one knew what would be done with regard to securities, whereas the proposal of the Bill would at least give the same income in the new stock as in the old.

The House divided upon the amendment, and it was lost by a majority of 74.

On clause 8, which provides that the Water Board shall, within 80 years from March 31, 1903, purchase or redeem or pay off all redeemable debenture stock and all mortgage debts,

Mr. HALDANE moved an amendment extending the period of redemption to 100 years. He pointed out that Lord Llandaff's Commission, having regard to the enormous magnitude of the transaction, recommended that the period of charge should be the time he had mentioned.

Mr. LONG signified his assent to the amendment, which was, without further discussion, agreed to, and the clause was added to the Bill.

On clause 9, containing special provisions with regard to the New River Company,

Mr. GRANT proposed to move an amendment which would provide that adventurers' or King's shares should not be deemed to be freehold property for the purposes of the parliamentary or any other franchise.

Mr. LONG said he did not think the amendment was necessary; but he would consider the matter before the report stage, and, if any words were needed, he would introduce them

The amendment was, by leave, withdrawn, and, after some further discussion, the clause was agreed to.

Clause 10, containing provisions as to the Staines Reservoirs Joint Committee, was agreed to, as were also clause 11, dealing with the transfer of the water undertakings of the Tottenham and Enfield District Councils to the Board, and clause 12, providing for the exemption of Croydon and Richmond, and the districts of Cheshunt and Ware.

On clause 13, making provision for the Councils of the boroughs of Croydon and Richmond, and the urban districts of Cheshunt and Ware, or the Council of any rural district situate wholly or partly within the area of supply, to obtain water in bulk from the Board,

Mr. LOUGH moved an amendment with the object of extending the right of taking water in bulk from the Board to any urban district within the area of supply.

Mr. LONG opposed the amendment; stating that the matter had been fully considered by the Joint Committee.

On a division, the amendment was negatived by 139 votes to 47.

Dr. MACNAMARA moved the omission of the provision declaring that the Water Board shall, if required, supply water in bulk to "the Council of any rural district situate wholly or partly within the limits of supply."

The amendment was rejected by a majority of 97; and the clause was added to the Bill.

On clause 14, containing special provisions as to Hertfordshire,

Mr. CREMER asked the reason for the exceptional treatment of this county.

Mr. LONG said the case of Hertfordshire had been put before the Joint Committee, and carefully considered, and this clause was the result. Practically all the water in the county was taken for the supply of London, and there were many districts where the people literally did not know where to turn for it.

Mr. BUXTON said he should like to confirm what the right honourable gentleman had stated. The way in which Hertfordshire had been depleted by the Water Companies was scandalous; and he thought far too much water had been taken out of the county.

The clause was added to the Bill.

On clause 15, dealing with the expenses of the Board,

Mr. H. ROBERTSON moved the insertion of words providing that the Board should exercise their powers to charge water-rates in such a manner as to produce within three years from the appointed day the equalization of such rates as between all parts of the area, both with respect to charges on rateable value and other charges.

Mr. LONG said sub-section 6 of the clause was inserted before the Joint Committee at the instance of the City of Westminster, whose action had been adversely criticized—he thought without much justice. The City of Westminster had, it must be remembered, to bear a very large proportion of the cost, whether one was dealing with water charges or the general rates of the Metropolis. He expressed his agreement with the view that it was desirable to equalize the water charges, but said that, unless such a course were absolutely unavoidable, nobody suggested that this ought to be done at the cost of the general rates. He proposed to make some alterations which, he hoped, would meet the wishes of honourable members on both sides of the House, and be accepted in place of the amendments on the paper. The sub-section would then provide that the Water Board should not, until Parliament otherwise determined, reduce the rates charged for the supply of water below those in force during the quarter ended June 24, 1902, unless the Board were satisfied that such reduction would not cause a deficiency in the water fund. In addition to these alterations of the wording of the sub-section, he would add to it a provision that the Board should, within three years after the appointed day, introduce into Parliament a Bill providing for a uniform scale of charges.

Mr. BUXTON thought the proposal was a very fair one, and thanked the right honourable gentleman for meeting the views expressed on both sides of the House.

Mr. ROBERTSON also thanked Mr. Long, and thereupon withdrew his amendment.

At a later stage of the proceedings,

Mr. LONG moved to add to the clause the following proviso: "The Water Board shall, within three years after the appointed day, introduce into Parliament a Bill providing for a uniform scale of charges applicable throughout the limits of supply."

The amendment was agreed to.

Mr. HAY moved the following addition to the clause: "Within three years after the appointed day, the Water Board may prepare a scheme enabling their assessments and charges for water supplied for domestic and trade purposes to be assessed, levied, and collected half yearly to Sept. 30 and March 31 respectively, together with the general, poor, or general district rate. Each constituent authority and rating authority

within the area of the Water Board shall consider and transmit their objections to the Local Government Board within 40 days after the scheme is published in the 'London Gazette.'"

Mr. LONG said there were practical difficulties in the way of any compulsory uniformity. The charges did not always fall on the same individual in respect of the same occupation; but uniformity was made possible, if not compulsory, by his honourable friend's amendment.

The amendment was agreed to.

Mr. LOUGH moved to add the following proviso at the end of the clause: "In levying the water-rate, the Water Board shall not give preference or exemption to any person or property unless such preference or exemption be extended to all persons and property similarly situated."

Mr. LONG said it was not alleged that the concessions by the Water Companies to the consumers were the result of any collusion between them. It would be the duty of the Water Board to consider whether they should continue the system of charges or not; and if they thought that, in the long run, it would be to their interest commercially, they would do so. Surely they ought to give to the Water Board at least the same power and discretion as the Water Companies; but the amendment would place them in a worse position.

The amendment was negatived; and the clause, as amended, was added to the Bill.

Clause 16 ("Powers of Borrowing") was agreed to, as were also clauses 17 ("Issue of Water Stock") and 18 ("Provisions as to Discharge of Loans," &c.)

Clause 19 ("Accounts and Audit"), 20 ("Provisions as to Payment by the Water Board"), 21 (Powers of Certain Local Authorities to Borrow"), and 22 ("Application of Capital Receipts"), were also agreed to.

On clause 23, which establishes a Court of Arbitration, consisting of "the Right Hon. Sir Edward Fry, Sir Hugh Owen, G.C.B., and Sir John Wolfe Barry, K.C.B., and defining its powers and authority,

Mr. BUXTON moved to include in the terms of reference words to the effect that the authority of the Court of Arbitration should enable them, with their other powers, to ascertain, determine, and declare the fair and reasonable value of each Metropolitan Water Company; and that, in order to ascertain such value, they should "inquire into and consider all the circumstances of the case."

Mr. LONG expressed the hope that the amendment would not be pressed. He said that the clause as it stood was wide; and he was sure the Court would take into account all the circumstances of the case, and any representations made to them by the parties concerned. The amendment might only introduce ambiguity into the clause.

The Committee divided, when the amendment was rejected by 117 votes to 31.

Mr. LOUGH moved an amendment to provide that any of the constituent authorities should be entitled to attend and give evidence before the Court of Arbitration.

Mr. GRANT LAWSON opposed the amendment as unnecessary; holding that all the constituent authorities would have representation through the Water Board.

Mr. BUXTON said the desire was to give the London County Council *locus standi* to appear individually before the Arbitrators. They possessed an enormous amount of information which would be of great value.

Mr. LONG said he could not consent to such a proposal. The Council would have representation before the tribunal through its representatives on the Board, and he could not agree to give it a separate representation.

The amendment was negatived, and the clause ordered to stand part of the Bill, as were also clause 24 ("Subsidiary Powers of Water Board") and clause 25 ("Provisions for Securing the Supply of Pure and Wholesome Water").

On clause 26, which deals with the power of the Local Government Board to make Provisional Orders for certain purposes,

Mr. LOUGH moved an amendment to omit the first sub-section, which gives the Local Government Board power, by reason of the variation in the population of any district, to make an Order altering its representation on the Water Board.

Mr. LONG said he did not think this power was of a very important character, but, at the same time, it might be useful. It was obvious that no change could be made in the constitution of the Board except by Provisional Order.

The amendment was negatived without a division, and the clause added to the Bill, as were also clauses 27 to 31.

On clause 32, which provides that it shall not be lawful for the Water Board, without the authority of Parliament, to supply water in the part of the parish of Hendon, which is within the limits of supply of the Colne Valley Water Company,

Mr. LOUGH moved to add: "Provided that the sum to be paid by the Water Board to the Company of Proprietors of the West Middlesex Water-Works for their right to supply in the part of the parish of Hendon aforesaid shall be separately determined by the Court of Arbitration, and shall be repaid to the Water Board by the Colne Valley Water Company."

The amendment was rejected by a majority of 92, and the clause added to the Bill, as were also clauses 33 to 36.

On clause 37 ("Definitions," &c.), which declares that the "appointed day" for the transfer of the undertakings shall be Dec. 25, 1903, "or such other day, not being more than 18 months later, as the Local Government Board may appoint,"

Mr. LONG said the appointed day was fixed when they hoped the Bill would receive the Royal Assent in August or September last. Obviously this could not now be done till the end of this year; and he would accordingly move that the date be June 24, 1904. He thought 18 months would not be an extravagant time to fix for the completion of the transactions in connection with the purchase of the water undertakings.

Mr. BUXTON asked whether discretion would be given to the Local Government Board to extend the time for 18 months beyond the appointed day. If the words "not being more than 18 months later" were retained, the period might be practically three years.

Mr. LONG moved amendments changing the date and omitting the words referred to, and they were agreed to; and the clause, as amended, was ordered to stand part of the Bill.

Clauses 38 and 39 ("Repeal" and "Short Title") were passed with a verbal amendment to the former.

On clause 40, providing for the maintenance of the undertakings till the appointed day,

Mr. LONG moved to add at the end the words: "In determining the compensation for the transfer of the undertaking of a Company, the sum payable to the Company under this section shall not be valued as forming part of the undertaking."

The amendment was agreed to, and the clause was ordered to stand part of the Bill, as were also clauses 41 to 46 inclusive.

On clause 47, dealing with the existing officers and servants,

Mr. LONG moved to insert words to the effect that any appeal to the Treasury be made within three months after the decision of the Water Board.

The amendment was agreed to, and the clause passed.

On clause 48, providing for compensation to Directors,

Mr. LOUGH moved to omit sub-section 3, which, he explained, proposed to compensate Directors who were members of the Staines Reservoirs Joint Committee for loss of their position. He pointed out that these gentlemen were already Directors of the Water Companies concerned in that scheme, and he contended that they ought not to be compensated twice over.

Mr. LONG said this proposal was not in the original Bill, but was inserted by the Joint Committee, apparently for good reasons, and he was prepared to stand by their decision, though he did not intend to influence the decision of the Committee in the matter.

The amendment was agreed to.

On the question that the clause stand part of the Bill, a division was challenged by Mr. Lough against the principle of paying compensation to Directors for loss of office; but the clause was agreed to by a majority of 81.

On the motion of Mr. LONG, the following new clause was inserted:—

Provisions as to Stamp Duty on Transfer.—Where the amount of the consideration for an undertaking transferred to the Water Board under this Act is not ascertained before the appointed day, the date of the final ascertainment of that amount shall, for the purposes of section 12 of the Finance Act, 1895 (which relates to stamp duty on property vested by Act of Parliament), be treated as the date of vesting.

This disposed of the clauses.—Schedule III. ("Representation of Authorities on Water Board") was omitted; and the other schedules were agreed to without amendment.

The Bill, as amended, was then, amid cheers, ordered to be reported to the House. This was done shortly after midnight, the twelve o'clock rule having been suspended to allow of the Committee stage of the Bill being completed.

Wednesday, Dec. 10.

To-day the Bill, as amended in Committee, was considered.

Mr. CREMER moved to omit clause 1 ("Establishment of Water Board"). He said this clause was the foundation of the Bill, and he and those who agreed with him were anxious to exclude it, in order that they might in this way defeat the whole measure.

Mr. LONG said it would be to the convenience of the House if he now made a statement as to the course the Government proposed to take in regard to the Bill on the report stage. There had been various suggestions made, to some of which the Government had been able to consent, while others he had promised to consider on report. The first was the amendment in the name of the honourable member for Poplar (Mr. Buxton), to the effect that the election of the Chairman and Vice-Chairman of the Water Board should not create vacancies in their respective constituencies. This he proposed to accept. Another which would be proposed would be to revert to the original proposal, whereby the Chairman and Vice-Chairman would be appointed by the Water Board itself, and not by the Local Government Board, and, furthermore, it would be rendered optional with the Board whether or not these functionaries were paid salaries. As to the question of numbers, the Bill originally put the number of the Board at 73. In Committee, they had taken five members away from the whole of the Metropolitan boroughs, and he had promised to consider whether he could not, by rearranging some of the outside areas, add to the representation of Inner London. He had accordingly considered the matter, and had been able to find four members from the outside areas, which he proposed to add to the representation of the London County Council. This would make the number of the Board 66, or 68 if the Chairman and Vice-Chairman were elected from without. On the subject of arbitration, the Government proposed that purchase by agreement should not be valid, unless the purchase arrangements had been submitted to the Court of Arbitration and had received their approval; and the Court would be given full power to deal with the contract when it came before them. He would ask the House not to amend the clause relating to the New River Company, as it was an agreed clause carefully prepared by the Company, and he had not been able to consult them. If, however, amendment was necessary—and the clause seemed to go too far—it would be effected in the House of Lords. It was proposed to accept an amendment by the honourable member for Battersea (Mr. Burns) to the effect that the members of the new Water Board should be no longer members if they ceased to be members of the Councils electing them. It would also be provided that Directors in the Water Companies should not be appointed on the Water Board while the question of purchase was being dealt with; and, by another amendment, the members of the Thames and Lea Conservancy Boards who would be put upon the Water Board would not be allowed to take part in the negotiations and decision as to purchase. As to the amendment just moved, he was, of course, unable to accept it, as it went to the root of the controversy on the Bill, which the Government had now finally concluded—and, he hoped, in a good-humoured and reasonable way. All he would say was that, in arriving at their decision, they had not been actuated by any feeling of hostility to the London County Council. The governing principle with them had been that of representation.

On a division, the clause was agreed to by a majority of 63.

Mr. LONG then moved an amendment by which the Chairman and Vice-Chairman of the Board are to be appointed by the Water Board, and not by the Local Government Board; and this having been passed, he submitted another providing that the number of representatives of the London County Council on the Water Board should be 14 instead of 10. He explained that, in accordance with the pledge which he gave in Committee, he had, by a rearrangement of their representation, obtained two members from Kent and Surrey, and he had taken two members from the representation of the Thames Conservancy. He thus got four members, and these he added to the representation of the London County Council. The number of the whole Board was, accordingly, reduced to 66, exclusive of the Chairman and Vice-Chairman. He hoped this arrangement would meet with the general approval of the House.

The amendment was agreed to.

Mr. LONG, pursuant to an arrangement which had been made, moved an amendment by which the representation of the Thames Conservancy on the Water Board was reduced from three to one.

Sir F. DIXON-HARTLAND submitted that the Conservancy were entitled to a larger representation than one, since they had control of the water which was to be handed over to the Board. They ought to have at least two representatives.

The amendment was agreed to.

Mr. LOUGH moved to omit from clause 2, sub-section 2, the words "as compensation;" leaving the clause to read: "The Water Board shall pay each Company for the transfer of their undertaking," &c. He said the price of all the London water stocks had risen, and he attributed this to the presence of the words "as compensation," which were not in the Bill when introduced.

Mr. LONG said the honourable member had referred to the rise in the price of water stock, but had not said how much had changed hands.

The amendment was rejected.

Mr. LONG moved to amend clause 15 ("Expenses of Board") by striking out the sub-section which provides that within three years after the appointed day the Board may prepare a scheme enabling their assessments and charges for water to be assessed, levied, and collected half yearly to Sept. 30 and March 31, together with the general poor or general district rate, in order to insert the following: "Within three years after the appointed day, the Water Board may prepare and publish in the 'London Gazette' a scheme enabling their charges for the supply of water to be collected together with any local rate. Any local or rating authority within the limits of supply may transmit to the Local Government Board their objections to any such scheme within 40 days after the scheme is published in the 'London Gazette.'"

The amendment was agreed to.

An amendment to clause 14 ("Powers of Borrowing") was agreed to, extending from 80 to 100 years from March 31, 1903, the period for the repayment of money borrowed under the Act for the purpose of payments to a Water Company or to the Urban District Council of Tottenham or Enfield, or of redeeming or paying off debenture stock or mortgage debt.

On clause 37, defining the terms and phrases used in the Bill, the insertion of words proposed by Colonel Lockwood in regard to the appointed day was agreed to. The Bill fixes June 24, 1904; and the words added at the end of the clause were: "That no date earlier than June 24, 1904, shall be appointed as respects any Metropolitan Water Company without the consent of the Water Company and the Water Board."

Mr. LOUGH moved to omit clause 48, dealing with compensation to Directors; but, on a division, the clause was retained by a majority of 42.

This completed the consideration of proposed amendments to clauses.

On Schedule III. ("Constitution and Proceedings of Water Board"),

Mr. BUXTON moved to insert the word "not" in the third line, in order to make it read: "The person appointed Chairman or Vice-Chairman need not be a member of the Water Board; but if a member of the Board is appointed Chairman or Vice-Chairman, the appointment shall *not* create a casual vacancy."

Mr. LONG, in accordance with an undertaking he had previously given, accepted the amendment.

Dr. MACNAMARA moved the first of a series of amendments providing against an outsider being selected to represent the constituent authority on the Water Board.

Mr. LONG thought that, if the authority could find a more competent person from outside than any within their own body, they should not be precluded from exercising this option.

On a division, the amendment was rejected by a majority of 4—a result which was received with laughter by the Opposition.

Mr. LONG moved an amendment providing that a Director of a Metropolitan Water Company should, until the compensation payable to the Company was determined, be disqualified for being appointed a member of the Water Board.

Mr. LOUGH moved to amend the amendment by the insertion after "Director" of the words "or a shareholder;" but his proposition was defeated.

An amendment was agreed to providing that the members of the Water Board appointed by the Conservators of the River Thames and the Lea Conservancy Board should not vote or act in respect of any question arising before the Board in regard to the transfer of any undertaking under the Act.

Amendments giving effect to Mr. Long's undertaking to rearrange the representation of the outside areas, so as to give the London County Council four additional representatives on the Board, were also agreed to.

This concluded the report stage.

Mr. LONG, with the consent of the House, then moved the third reading of the Bill.

Sir CHARLES DILKE said the measure would involve the purchase, at enormous cost, of dirty water from a dying river; and the very first time there was a cholera scare, the new authority would be driven to frame a new scheme for bringing a fresh supply to London. To administer the water supply of the Metropolis, a cumbrous body had been created to discharge a duty which ought to have been thrown upon the London County Council.

Mr. BUXTON said that, in spite of the improvements which had been introduced into the Bill, he could not refrain from renewing his protest against it; and he should certainly divide against the third reading.

Colonel LOCKWOOD was glad that the Government, yielding to what had become a popular cry, had found themselves in a position to settle this water question for a time. They must all acknowledge the care and trouble which the President of the Local Government Board had given to the question, and the way in which he had endeavoured to hold the scales fairly between the parties interested and the public. At the same time, he could not believe that the members on the Board would produce either a workable or an economical body.

Mr. LOUGH did not think that, viewed in its great material aspects, the Bill could be regarded as one whit better than when it was originally introduced. His conviction as to the absolute necessity of entrusting this business to the London County Council remained unshaken.

Mr. WHITMORE regarded it as almost frivolous, after the long discussion that had taken place, to speak of their purchasing "dirty water from a dying river. The transfer of the water undertakings from the Companies had become a necessity, and, on that ground, he supported the Bill; and he was surprised that criticism of the principle of purchase should have come from the other side, who had convinced the people of the desirability of adopting that principle. (Hear, hear.) He was delighted to hear from the member for Battersea that the London County Council would do their best in assisting to make the Bill work successfully. (Hear, hear.)

Mr. BURNS said he believed that many of the difficulties conjured up by the honourable member for Islington (Mr. Lough) would not be realized, for London would prove itself equal to the occasion. To his mind, the most sweeping condemnation of the Bill had been pronounced by a staunch supporter of the Government, when he expressed the view that the measure would not be economical, but costly to the ratepayers. He wished to tell the President of the Local Government Board that his Department made a great mistake when it did not help the County Council in 1896 to prosecute their Welsh Water scheme.

Mr. LONG expressed his pleasure at reaching the end of the controversy. He could only hope that the good wishes which he and others had expressed might be fully realized. He believed that the future of the measure was not so melancholy as some honourable gentlemen seemed to anticipate. He thought the inhabitants of London, so far from finding the Bill an incubus and a curse, as some people had represented it, would find in it a real and lasting solution of a question which had too long troubled the public mind.

The House then divided, when the numbers were: For the third reading, 104; against, 28—majority 76. The announcement of the numbers was received with Ministerial cheers.

HOUSE OF LORDS.

Friday, Dec. 12.

LONDON WATER BILL.

The above Bill, which had been brought from the Commons and read the first time on Wednesday, came before their Lordships for second reading.

Lord BALFOUR, in formally moving that the Bill be read a second time, said he would defer his remarks upon the measure until he saw what points were raised in opposition to it, and then deal with the objections.

Lord TWEEDMOUTH moved that the Bill be read a second time that day four weeks. He said he believed that all were agreed as to the necessity for acquiring the undertakings of the London Water Companies; and he admitted that the Bill had been much improved since it was introduced. He nevertheless thought he was justified in moving its rejection at this stage, because he objected to the constitution of the Board which it was proposed to establish. He maintained that a fair and common-sense proposal would have been to make the London County Council the authority to purchase the Companies' property and to control the water supply of the Metropolis. But, even assuming that the Council were not the proper authority, he would ask their Lordships to reject this measure, because the projected Board, consisting of 68 members, was far too large, too unwieldy, and without cohesion.

Lord BALFOUR said he was confident that he should be able to make out a good case, on the merits, for everything contained in the Bill. He ventured to lay down as an axiom that the Water Authority of the Metropolis must include a representation both of the London County Council and of the outside areas. The plan adopted in the Bill was to give the representation due to London partly to the County Council and partly to the sanitary authorities of the Metropolis. Outside London, the County Councils and the sanitary authorities were also represented. Having explained at some length the proceedings of the Joint Committee who considered the Bill, of which he was Chairman, and offered some remarks in justification thereof, he concluded by expressing the opinion that the new body proposed to be created would be capable of managing the water supply of London with thorough efficiency.

Viscount LLANDAFF, as a member of the Joint Committee, said he was satisfied, from the evidence given by the various bodies concerned, that they would not deal with the London Water Question in the way in which it should be treated. The water supplied by the existing Companies was a highly manufactured article, which required very careful supervision to procure. But instead of having experts to manage the supply, the Government had chosen the remarkable and novel system embodied in the Bill. He acknowledged the impossibility of constituting the proposed Water Board on more manageable

lines than those laid down in the Bill without altering the entire character of the measure; but he could only express his regret that the Government had adopted the system of a cumbrous and unwieldy Board.

Lord AVEBURY expressed the opinion that while the Government scheme would not affect either the quality or the quantity of the water supplied, it would increase the cost; as the proposed Board did not seem to him to be likely to conduct the business with efficiency and economy.

Lord MONKSWELL, as Vice-Chairman of the London County Council, said he wished to support their action in condemning the Bill by 70 votes to 19. He considered that the provisions of the measure were unduly favourable to the Water Companies, who, he was told, were raising their rates all round in view of purchase.

Viscount HAMPDEN (the Chairman of the Lambeth Water Company) gave a most unqualified and deliberate denial to the last remark of the noble Lord, and said it was a pity such statements were made without any trouble being taken to verify them.

Earl RUSSELL contended that the Bill was opposed to the system of municipal government, and that the effect of passing it would be to increase the water-rates instead of reducing them.

The House divided, when the motion was carried by 51 votes to 18—a majority of 33. The Bill was then read a second time.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Dec. 12.

(*Before Mr. Justice* BYRNE.)

Beven and Alexander v. Welsbach Incandescent Gaslight Company.

This motion for sequestration and attachment, which was opened a fortnight ago (*ante*, p. 1479), and stood over in the hope of its being settled, was renewed to-day.

Mr. ROWDEN, K.C., and Mr. GRAHAM appeared for the plaintiffs (the owners of the "Vivid" incandescent mantle); Mr. LEVETT, K.C., and Mr. WALTER for defendant Company; and Mr. MULLIGAN, K.C., Mr. TERRELL, K.C., and Mr. MEYER for the Directors.

Mr. ROWDEN briefly recalled the circumstances which he had mentioned on the former occasion; submitting that the defendants had committed a breach of their undertaking in two respects—first, by letters to Messrs. Faudell, Phillips, and Co., which contained threats, and, secondly, by bringing an action for infringement against the plaintiffs, which he contended was a breach of the undertaking not to allege that the "Vivid" mantle was an infringement of the Welsbach patent. He cited two cases (*Skinner and Co. v. Shoe and Co.*, 1893, and *Douglas's* case, 1897, Chancery Division), to show that an answer to an inquiry by letter was none the less a threat, if it intimated that legal proceedings were intended.

Mr. GRAHAM having followed on the same side,

Mr. LEVETT submitted that the motion failed entirely, and ought to be dismissed with costs. The undertaking was not to threaten; and no threats had been used. He read and commented on the letters which passed, and suggested that they showed an attempt to entrap the defendants into making threats, which they had been very careful to avoid. With regard to the action for infringement, he denied that it was a threat in any sense of the term. Doing a thing was not the same as threatening to do it; and with regard to "alleging," he said this part of the undertaking was never intended or understood to prevent the bringing of an action. It was put in really to cover the possible verbal representations, as distinct from the issue of circulars or advertisements.

Mr. WALTER enforced the same point at some length.

Mr. MULLIGAN, Mr. TERRELL, and Mr. MEYER having addressed the Court on behalf of the Directors, who disclaimed any intention of breaking their undertaking,

Mr. ROWDEN, in reply, submitted that his learned friends had entirely failed to meet the case made on the motion, and again cited certain passages from the judgments he had already referred to.

Justice BYRNE, in giving judgment, said this was a motion asking for sequestration against the Welsbach Company, and to attach certain Directors of the Company, for an alleged breach of an undertaking contained in a judgment of the Court given on June 20, 1902. The plaintiffs, trading as the "Vivid" Patent Incandescent Mantle Company, were the owners of a patent for an incandescent mantle; and the Welsbach Company having made some threats, an action was brought seeking to obtain the benefit of section 32 of the Patent Act, 1883, providing for protection against threats. A motion was made in the action; and upon its coming on, a consent order was taken, which, in fact, put an end to the action. The material part was as follows: "The defendants, by their Counsel, undertaking not to threaten any person or persons by letters, circulars, advertisements, or otherwise with legal proceedings or liability in respect to the manufacture, sale, use, or purchase of the mantles made or sold by the plaintiffs, and not to allege that such manufacture, use, sale, or purchase is an infringement of the letters patent belonging to the defendants, the Court doth order that the defendants pay the plaintiffs their costs of the action to be taxed, and that all further proceedings be stayed except such as may be necessary to enforce this order, and with liberty to apply." Since that action was put an end to, another one had been brought by the Welsbach Company against the plaintiffs in the former action asking for an injunction to restrain an alleged infringement of the Welsbach Company's patent; the alleged infringement being the use of the "Vivid" mantles. The applicants relied upon two grounds in respect of which they said a breach of undertaking had been committed. The first of these was that, by the issue of the writ in the new action, a breach had been committed, because there had been an undertaking not to allege that the manufacture, use, &c., of the "Vivid" was an infringement of the patent; but, on careful consideration of the form of the order and the undertaking, he had come to the conclusion that the true meaning of it was not to preclude the bringing of an action against the then plaintiffs. So far as that was concerned, therefore, the motion failed. The other point relied upon was that there were some customers of the plaintiffs against whom threats had been made before the former action was brought. They, hearing, he supposed, of the new action which had been brought by the Welsbach Company, and being still purchasers and sellers of "Vivid" mantles, wrote to the Welsbach Company. He should pause to say that he read that order and undertaking as meaning, of course, that, whether an action was brought against the "Vivid" Company or not, there would be no threats and no breach of the undertaking was to be committed during the pendency of the action. That was one of the things he thought they lost by not having brought their action at an earlier time. The reason they gave for not having brought their action was plausible enough. They were advised that they could not resist the injunction restraining them from issuing threats, having regard to the delay; and they were advised, moreover, that a counterclaim would be a more inconvenient form of action than to bring an entirely new action against the "Vivid" Company. Mr. Davis, a member of the firm of Faudell, Phillips, and Co., who had been buying and selling the mantles, said they had not received or heard of any threat; but having regard to the knowledge of the continuous litigation which the defendant Company had been engaged in against the manufacturers of "Vivid" mantles, he wished to satisfy himself that his firm would not be incurring any liability in selling them. He therefore wrote to the Welsbach Company saying it had come to his knowledge that the Company contemplated taking proceedings against the firm in consequence of their selling "Vivid" mantles; and he asked if there was any truth in this. To this the answer of the Secretary of the Welsbach Company was that an action had been commenced and was proceeding against the proprietors of the "Vivid" mantle; but that he had so far received no instructions from the Board with reference to bringing an action against Faudell, Phillips, and Co. What answer could have been returned, assuming the Welsbach Company were entitled to bring an action such as they had brought against the "Vivid" Company, without committing a breach of the undertaking which had been given by them? Messrs. Faudell, Phillips, and Co. then wrote again asking if they were to understand that they were liable in any way if they still continued the sale of the "Vivid" mantle, and saying that if the Company considered the "Vivid" mantle an infringement the firm would immediately stop its sale. This was an awkward letter to answer, seeing that the Welsbach Company must not threaten. The reply sent was that the undertaking given by the Welsbach Company not to threaten customers of the "Vivid" incandescent mantle, in no way prevented them (the Welsbach Company) bringing and prosecuting the action which they had felt compelled to bring to have it judicially declared that the "Vivid" mantle was an infringement of their patent. This letter was expressly framed so as not to contain in terms any threat, and yet not to give away any right which the Welsbach Company supposed they might have in the future. He was not surprised that there was a temptation to bring the motion, and particularly with the construction which the applicants put upon the undertaking, because if it had been the true construction of the original undertaking that no action might be brought against the "Vivid" Company, the letter would constitute a threat. The learned Judge then referred to the two cases which had been cited by Mr. Rowden in his argument, and pointed out that in neither instance was an action actually pending. Having given careful attention to the arguments, he (Justice Byrne) thought that this motion was misconceived, having regard to the construction he put on the undertaking. It failed, therefore, with costs.

Mr. ROWDEN asked for leave to appeal.

His LORDSHIP said he did not think his consent was necessary; but he would certainly give leave.

Defective Meter Registration.

At the Clerkenwell County Court, a few days ago, before his Honour Judge Edge, the Gaslight and Coke Company sued Mr. Henry Binco, of 4, Highbury Crescent, for £11 1s. 2d. in respect of gas supplied and for the hire of a stove. Mr. Gibson appeared for the plaintiffs; the defendant conducted his own case. The period in respect of which the claim was made extended from the 19th of December, 1901, to the 24th of June. Witnesses were called to show that on the first-named date the index on defendant's 10-light meter showed 234,600 cubic feet; on the 15th of March, 263,600 cubic feet; and on the 24th of June, 276,000 cubic feet. Defendant cross-examined each witness as to the condition of the meter, and elicited the statement that nothing had been done to it since it was fixed in 1898. Walter Lound, an inspector of meters to the London County Council, said he received a meter from the defendant on the 23rd of October. He tested it, and found it was about one-third slow. If a meter was not attended to for four years, it might vary slightly on either side—fast or slow; but the variation in this case was rather large. He thought the meter was slow at Mr. Binco's house; and the effect would be that the gas would be passing to the extent of 150 cubic feet and the meter would register only 100 cubic feet. Defendant said he had offered £6 6s. 3d.—the amount he paid last year; but the Company refused to accept it. Mr. Gibson admitted that this amount was offered. Defendant handed up to his Honour a comparative table of his gas account for the past three years. It showed, he said, according to the Company, that the consumption had grown rapidly, and for no reason whatever. He had used no more gas one year than another, but still the Company charged him £2 or £3 more. He believed he had been going on for years paying for more gas than he consumed, simply because the meters were defective. His Honour pointed out that the defendant agreed to have gas from the Company; and the only way of knowing how much was consumed was by the meter index. Defendant admitted that this was the established rule. His Honour: Then you must be bound by your meter until you can show that it is wrong. The verdict must be for plaintiffs, with costs.

Director's Claim against a Gas Company.

At the Crediton (North Devon) County Court, a few days ago, before his Honour Judge Lush Wilson, K.C., a case of considerable interest was heard. Mr. James Buckingham, of Crediton, formerly Secretary and a Director of the Crediton Gas Company, claimed of the Company £2 Director's fees, and a further sum of £2, the value of fruit trees which had been planted on the defendants' property, and of which they refused to give up possession. The case for the plaintiff was that twenty years ago he was appointed a Director, and a few years afterwards Secretary, of the Company, at a salary of £30 per annum. He was not, however, to participate in the fees paid to the Directors. On the 25th of March last, he resigned the secretaryship, but continued a Director until July. He attended four meetings of the Board, and claimed for his services £2; being at the rate of 10s. per meeting, the amount always paid. In July, he parted with his financial interest in the Company. As the holding of shares was necessary to qualify for the directorate, he, of course, attended no more meetings. When the Directors' cheques were subsequently paid, he asked why his had not been received; and he was told that no fees were due to him. While he was Secretary, he had the use of a small piece of land around an old gasholder; and on this he had planted some apple trees. The Company at first recognized his right to these, and asked him to remove them; but as it was not the proper time of the year to do so, he pointed this out, and asked to be allowed to remove them at a suitable time. Subsequently, when he asked for the key to do this, it was refused. For the defence, it was contended that no Director who relinquished his position could claim remuneration for single meetings. If he resigned during the year, he was not entitled to anything for that period. As soon as he took the office of Secretary, he could not remain a Director. Mr. J. Cleave, one of the Directors, said he remembered Mr. Buckingham attending the April meeting. All the Directors wondered why he was there, and looked upon him as a trespasser. He said he had come to look after his interests. He (witness) did not believe Mr. Buckingham took any part in the voting at the meetings he attended. At the April meeting he only joined in a general discussion. His Honour allowed plaintiff 10s. for his services as a Director at the April meeting, after which his resignation took effect; but he disallowed the claim for the trees.

Claim against the South Shields Gas Company.

Last Thursday, his Honour Judge O'Connor heard, at the Shields County Court, a case in which Margaret Brown, a widow, of Jarrow, claimed £36 15s. damages from the South Shields Gas Company, in respect of injuries received by her in consequence of the alleged negligence of their servants. Mr. A. Smith appeared for the plaintiff; Mr. Meynell represented the Company. The plaintiff was walking along Nansen Street, and when half-way down fell over some boards which the Company's workmen had left on the pavement. She injured her arm, and suffered considerable pain. The street at that part was dark. George Brown, the plaintiff's son, said that he afterwards examined the place, and saw the boards in a dangerous position. Dr. Bradley having given evidence as to the injuries, Mary Armstrong said she was present when the plaintiff fell, and saw some boards over the footpath where the accident happened. The street-lamp was not lit, and there was not sufficient light to see the boards without stooping to look for them. Mr. Meynell said there had been no evidence to show that the boards belonged to the Company; and his contention was that those used by the Company were not negligently put down, and were perfectly safe. Mr. T. H. Duxbury, the Engineer and Manager of the Company, said the boards used by them for covering new cement work were perfectly safe. Several employees gave evidence to the effect that the work was done and the boards were removed at nine o'clock the same night, whereas the accident was said to have occurred the following night. His Honour awarded plaintiff £29 damages.

Opening Streets by a Gas Company without Permission.

A fortnight ago, we reported (*ante*, p. 1481) a partly-heard case in which the Barnard Castle Urban District Council summoned the local Gas Company for breaking up the streets without permission; an adjournment being agreed to in order that the parties might endeavour to come to terms. When the hearing was resumed last Wednesday, it was announced by Mr. J. I. Dawson, the Clerk to the Council, that a conference had taken place the previous day between the Council and the Company; and, as a result, he had written putting the following questions to the Company: (1) Are the Gas Company prepared to admit that the streets within the urban district are vested in the Council? (2) Are the Gas Company claiming the right to break open the streets without permission or licence of the Council. The Chairman (Mr. R. T. Richardson), on behalf of the Company, had answered the first question in the affirmative and the second in the negative. The Company replied that such admissions were made on the assurance that the Council did not intend to make anything but a reasonable and moderate charge in respect of such opening. After further argument, Mr. Dawson intimated that he had come to terms with Mr. Heslop (who appeared for the Company), by which the Company submitted to a nominal fine of 1s., and would pay the damages previously agreed upon—7s. 6d.—and the costs. The Chairman said the Magistrates thought that was quite satisfactory.

Serious Gas Explosion in Liverpool.—Last Sunday week an explosion of gas occurred at Kirkdale, Liverpool, by which a woman named O'Neill was somewhat seriously injured, and much damage to property was caused. The explosion took place in connection with the lighting of a fire; and the accumulation of gas which caused it is said to have come through the flooring of the room. It is reported that the meter was turned off at the time, and that the gas must therefore have percolated into the house from the street-main.

MISCELLANEOUS NEWS.

THE PRICE OF GAS IN NORTH LONDON.

Joint Action by the Corporation and the London County Council.

At the Meeting of the Court of Common Council last Thursday, the Streets Committee submitted a report relative to the price of gas in the district north of the River Thames, and the decision of the Court of June 12 last to promote legislation in the matter in co-operation with the London County Council, provided that certain resolutions passed at the conference held at the Guildhall on Oct. 31, 1900, were not departed from without the consent of the Corporation. A letter was submitted from the Council in reference to the introduction into Parliament of a Bill, entitled the "Gaslight and Coke Company's Acts Amendment Bill," to provide: (*a*) For a reduction in the Company's existing standard price from 3s. 9d. to 3s. 3d. per 1000 cubic feet, coupled with a scale of increase or decrease of dividend equivalent to the secondary scale recommended by Sir James Rankin's Committee of 1899; (*b*) for a reduction in the standard illuminating power of the gas supplied by the Company from 16 to 14 candles, together with a reduction of 2d. in the standard price, which would thus become 3s. 1d.; and (*c*) for one-half of the Company's clear profits, if any, after paying a dividend of 4 per cent. per annum, to be carried to a fund to be applied to the redemption of obsolete capital. The Committee recommended that, though the Bill did not provide for so great a reduction in the price of gas as was originally intended, the Corporation should co-operate with the Council in promoting it. Mr. T. H. Ellis (the Chairman of the Streets Committee) moved that the Town Clerk be authorized to sign a petition, jointly with the London County Council, for leave to introduce a Bill next session. The necessary permission was given.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Labour Troubles—A Bill in Italy for the Municipalization of Public Services.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. ARTHUR LUCAS in the chair.

The SECRETARY (Mr. F. W. Himing) read the notice convening the meeting, as well as the Directors' report and the balance-sheet. The report was as follows:—

The Directors have to report that at Messina and Montargis, the two stations owned by the Continental Union Gas Company, Limited, the increase in the number of consumers is about 4½ per cent.; the increase in the quantity of gas sold being rather more than 5 per cent.

The net sum spent on capital account at these two stations during the year amounts to £1258; being for a new condenser at Messina, and for additional mains, lamps, and services. The net profits at these two stations have increased in a fairly satisfactory manner during the year under review.

With regard to the Union des Gaz, the total debited by that Company to capital account for work completed during the year amounts to £88,194. This includes purchases of land for an entirely new works at Nanterre, and new apparatus, mains, and services at the stations generally.

The average cost of coal shows a decrease of about 1s. 3d. per ton. The saving, however, has been far more than counterbalanced by the very heavy fall which has taken place all over the Continent in the selling price of coke and residuals,

There has been a net increase of 611 in the public lamps. The number of private consumers on the books of the Union des Gaz on June 30 last shows a further increase of 9903—equal to about 7 per cent.; making a total of 158,101 consumers now supplied by that Company. The increase in the quantity of gas sold is about 3½ per cent. The rate of exchange on remittances from Italy has shown a further improvement, and has also continued to improve since the date of making up the accounts.

The difficulties with the town of Milan, referred to on several previous occasions, have at last been settled by a reduction in the illuminating power of the gas, in exchange for a reduction of 1c. in the selling price of gas, together with the abandonment of certain claims the Company had against the town and private consumers.

Early in the summer the draft of a law was brought before the Italian Parliament, to enable the different municipalities to assume the conduct of various public services—including the supply of gas—by compulsory purchase or otherwise. This draft had to be withdrawn, chiefly on account of want of time; but it has been reintroduced in the winter session, which has just opened. The matter is receiving the most careful attention of the Directors.

The strike of all the men at Milan, Genoa, and Alessandria, mentioned at the last general meeting of stockholders, has largely reduced the profits of the Union des Gaz for the year, through the very heavy expenses it entailed upon that Company at the time, and in the large permanent increase in wages and reduced hours of labour.

From the above-mentioned causes, the Union des Gaz have had to reduce their dividend by 2 per cent.

Referring once more to the accounts of the Continental Union Gas Company, Limited, the decrease in the Union des Gaz dividend alluded to above, obliges the Continental Union Gas Company to reduce the dividend by 1 per cent., while adding £1376 17s. 7d. to undivided profits.

The net profits for the year ending June 30 amounted to £73,745 12s. 7d. From this, the Directors recommend a dividend of 8 per cent. per annum on the ordinary stock, free of tax, and of 7 per cent. on the preference stock, less tax. The Directors have also decided to transfer the sum of £5000 from the balance of undivided profits to the reserve fund. After deducting the interim dividend paid in July last, and paying the balance of 4 per cent. on the ordinary, and 3½ per cent. on the preference stocks, and providing for the transfer to reserve account, the total amount carried forward to the new account will be £10,871 5s. 1d. It is proposed to pay the dividend as usual, on Jan. 5 next.

One of the Auditors, Mr. I. A. Crookenden, having retired during the year, the Board have elected in his place Mr. C. P. Crookenden. The

Director who retires by rotation is J. Horsley Palmer, Esq., and the Auditors, A. T. Eastman and C. P. Crookenden, Esqs., also retire—all of whom being eligible, offer themselves for re-election.

The CHAIRMAN, in moving the adoption of the report which the Secretary had read, said it would be convenient to deal first with the affairs of this Company, and, secondly, with those of the Union des Gaz—the Company with which they were practically affiliated. In the two stations owned by this Company, there had been a fair increase in the profit; but, on the whole undertaking, they had earned £13,053 less than last year. This decrease was due to the dividend on the shares of the Union des Gaz being £13,500 less than in the previous year. Consequently, this had necessitated a reduction of the dividend, which the Directors regretted; and he hoped to show the shareholders that this reduction was due not to any lessening in the sales of gas, but to other causes which, although foreseen, could not have been avoided. He had said that there had been a reduction of their dividend from the Union des Gaz; and he would explain why there had been this reduction. But he thought that before doing so, it would make matters clearer to the shareholders if he stated the exact financial position of that Company. Their share capital was £1,000,000 sterling, and the debenture or bond issue amounted to £1,057,000; and when the new issue (to which he should again refer) was completed, the total amount of debenture capital would amount to £1,200,000. Now the profits of the Union des Gaz were £39,179 less than in the previous year; and this reduction was due to the following causes: (1) The strike at the Italian stations; and the consequent increase in wages and pensions. (2) The reduction in the price of gas in Milan and Modena. (3) The decrease in the price obtained for coke, tar, and other products. (4) The increase of interest on debentures and amortization. He would now deal with these matters in detail: (1) With regard to the strike, he would say very little, as this unfortunate event was fully explained to the shareholders by Mr. Tendron at last year's meeting, when, with the Chairman of the French Board, he (the Chairman) was engaged in Milan settling it. The disastrous policy of the Italian Government in refusing to protect the Company gave encouragement to impossible demands from the workmen in other parts of the country. Strikes occurred in Turin and other cities, which were followed by the railway labour troubles; and now the relations between employers and employed were more strained in Italy than in any other country in Europe. In order to avoid bloodshed and ruin to all concerned, the Directors gave the men very liberal terms—not nearly all they asked for, but what they did give had involved the Company in an increased annual expenditure of about £10,000. Now they would not so much mind the extra expense if the men would only fulfil the terms of their contract as honestly as the Company had theirs. Unfortunately, owing to the evil effects of the teaching of paid agitators, till now this had not been the case. A deputation of the men had lately been visiting some of the largest gas-works in this country. He (the Chairman) thought this visit had done good; and that the men had learned that the amount of work done by an Italian stoker was ridiculously small as compared with that of an Englishman. No further concessions would be made to the demands of the men; and this was intimated in a very amicable meeting he had with the deputation. He sincerely hoped that this visit of the Italian workmen's representatives to this country would be beneficial, and would lead to a better understanding in the future between the Company and their men. (2) The second cause—the reduction of the price of gas in Milan—was one of the consequences of the new contract with the Municipality of the city. It might be remembered that litigation had been carried on for several years in connection with the price of gas. The Company claimed that they had power to raise the price of gas when the price of coal was up to a certain figure. The Board were always advised that their case was a good one; and as the Company won in all the Superior Courts, their action in maintaining their rights was justified. The Directors felt, however, it would be advisable, if possible, to come to an arrangement; and a new contract, advantageous to both sides, had been concluded. He was glad to be able to announce that the relations with the Municipality of Milan were now perfectly cordial. (3) As for the coke sales, the shareholders would remember that last winter was a very mild one; and this fact, coupled with the depression of business on the Continent, caused a great fall in the price of coke. In fact, the loss on the coke sales alone amounted to £34,900. The previous year had been an exceptionally prosperous one; and it was some consolation that the existing prices were about normal. Tar and ammoniacal liquor showed a decrease amounting to £3466. (4) He now came to the last of the four causes of the reduction of the profits of the Union des Gaz, and that was the extra charge, amounting to £4700, for interest on debentures and their amortization. That Company were obliged to procure funds for the cost of the large works now in course of construction at Nanterre; and when these works, which would necessitate the expenditure of about £100,000, were completed, they would supply, with up-to-date machinery, a very large, growing, and important district in the neighbourhood of Paris. Money had also had to be found for increasing and reorganizing the works at Milan. These works, partly owing to the growth of the city, and also to the great increase in the consumption of gas on account of its low price, had to be provided with more modern machinery; and the large amount of £120,000 was being spent on improvements. In addition, there had been the usual demands for extensions at other stations, all of which had necessitated large expenditure. Now the Union des Gaz had raised the money for all this work as cheaply as they could—that was, by the issue of debentures. He had already mentioned that their debenture debt was now £1,057,000; and the Union des Gaz were raising £143,000 more, which would make the total debenture issue £1,200,000. But the limit of debenture issues was now reached; and, should further sums be required for extensions, other means would have to be found for raising capital. He thought now he had shown the chief causes of the diminution of the profits of the Union Company, and consequently of their own. One of these causes—for instance, the increase of wages—would be permanent. But it might fully be hoped that there would not be a further reduction of the rates obtained for coke and other residuals; and the shareholders might rest assured that the Directors would use their best endeavours to keep the increase of capital and expenditure within limits compatible with the welfare of the Company. But, as they had heard, the consumption of gas was ever increasing; and they must meet the demands. This fact was so evident that he need not enlarge upon it. The last matter he had to refer to was an important one, and that was the Bill for the municipalization of the public services in Italy, which they heard the previous day had been passed by the Chamber. This Bill had not in this country attracted the public attention it deserved; for no measure had been passed dealing in such a wholesale method with this difficult question. The Bill enabled any municipality in Italy, under certain conditions, to expropriate and to municipalize the public services which were now carried out by private companies holding concessions of more than five years' standing. The Directors, with the majority of the other Companies holding concessions in Italy, had been associated in opposing the Bill; and they had reason to believe that their joint action had been successful in modifying in their favour many of its provisions. As he had said, it was only the previous day that they learned the Bill had been passed. Consequently, he was not in a position to say more about it, as they did not know exactly how it had been altered in Committee. The shareholders might rest assured, however, that their interests would be safeguarded to the best of the ability of the Board. If they were only allowed to carry on their trade peacefully, they would do very well. They met with opposition and difficulties in Italy—and in Italy alone. Municipalities were obstructive; and the labour question was in a more acute state in that than in any other country. The Company had benefited the cities they served in Italy by supplying gas at very low rates. They were loyally fulfilling their contracts; and the wages they paid their men were equal to, if they were not higher than, those paid by other employers of labour. The Company had nothing to reproach themselves with; and if only they could be left alone, they would in the future be fairly prosperous. This had been an exceptionally anxious year for the Directors; but considering the difficulties they had had to deal with, and the fact that all industrial undertakings were subject to ups-and-downs, they had no reason to be discouraged because there had been a check, which they trusted was only temporary, in their prosperity.

Mr. N. E. B. GAREY seconded the motion.

A SHAREHOLDER asked whether the Chairman could not give a general outline of the Bill as introduced in the Italian Chamber.

The CHAIRMAN said the Bill had been so altered that he could not give any information which would be adequate. There was no member of the Board who knew how the Bill had been passed. All the information the Board had had was a letter written before the Bill appeared in the Italian Chamber on Saturday; and the rest of their knowledge was derived from the newspapers.

On the motion of the CHAIRMAN, seconded by the DEPUTY-CHAIRMAN (Mr. Frederick Tendron), the dividends recommended in the report were declared.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, Mr. J. Horsley Palmer, the retiring Director, was unanimously re-elected.

Rev. G. M. JONES moved the re-appointment of the Auditors (Mr. A. T. Eastman and Mr. C. P. Crookenden).

Mr. E. A. GOULDING, M.P., in seconding the motion, referred to the Bill for the municipalization of the public services, and said he hoped that nothing would prevent the Directors from exercising the keenest prevision (as he knew they had been), and not to rely too much on the Senate.

The motion was unanimously agreed to.

The DEPUTY-CHAIRMAN moved a resolution recording the indebtedness of the shareholders to the Secretary and all the officers abroad for what they had done for the Company during the past trying year. It was, he remarked, his duty, as the Director visiting the stations this year, to go to all the Italian stations as well as to their big city in Germany—Strasbourg—and the eight French stations. With regard to the Italian stations, he would say that—at the great cities of Milan, Genoa, and Alessandria—they had men in charge who were absolutely devoted to the interests of the Company. On M. Solanges, their Manager at Milan, a great burden had fallen—not only in dealing with the men, but in dealing with the Bill that had been brought into the Chamber by the Minister of the Interior (M. Giolleti). M. Solanges was still in Rome in connection with this matter; and he had rendered the Company the greatest service. He had given valuable assistance in the effort made to enable the Italian Government to see the full bearing of the Bill, and to see that full justice was done to foreign enterprise in Italy. The help rendered by the French Ambassador (M. Barrère) had also been very great indeed. Taking a sanguine view of this matter, he (Mr. Tendron) had the fullest confidence in the justice of the Italian Government. The various views bearing upon the question had been put before them plainly and fully; and he believed, when the Bill became law, they would find that all had been as justly dealt with as, he trusted, a great industry was now being justly dealt with by their own Parliament.

Mr. R. HESKETH JONES seconded the motion, which was heartily agreed to.

The SECRETARY cordially thanked the shareholders in the name of himself and his colleagues abroad, especially the Manager in Milan.

Mr. A. F. PHILLIPS said, as perhaps he was as well acquainted with Italian matters as any gentleman outside the Board, he might be permitted to propose a vote of thanks to the Directors. He could assure the shareholders, as he heard the speech of the Chairman, he could appreciate to the full the difficulties that those who had to deal with Italy now had to contend with. The bad faith of the municipalities was beyond all comprehension. It did not matter what concession they had granted, the one idea seemed now to be to break down concessions, and to deprive the companies of their property, at a price totally inadequate to its full value. He was pleased to hear Mr. Tendron, who had also had considerable experience, speak in such a hopeful way. He (Mr. Phillips) was sorry to say he was not able to endorse it; and he strongly advised the Company to fight with all their might and main against the aggressions which were now being made by the municipalities, and which, he was sorry to say, were being

countenanced by the present Government. It was all very well to speak of Giolleti and Zanardelli. It was no use denying that these gentlemen leaned towards the democratic party; and all municipalities in Italy at the present time contained a democratic majority. As to this Municipalization Bill, he had a telegram the previous day to say the Bill had been approved by the House with some satisfactory modifications. What the modifications were, he did not know, but what he did know was that the Marquis of Lansdowne and their Minister at Rome had been using their best endeavours on the part of shareholders who had money invested in Italy. He (Mr. Phillips) had had interviews with them; and they had assured him that everything that it was possible to do, kindly and with friendly remonstrance, with the present Government, would be done.

Mr. I. A. CROOKENDEN, in seconding the motion, said he wished to take exception to the observations of his friend. When Mr. Phillips suggested a policy of militancy, he (Mr. Crookenden) did not think that was quite wise. The policy should be one of conciliation from top to bottom; and every avenue and argument should be used in favour of arriving at a fair, equitable adjustment. With all deference to his friend, he urged the Board to pursue that policy to the end. He was sure they would get more by reasonable persuasion than by strenuous opposition and an antagonistic attitude.

Mr. A. T. EASTMAN said the truth might lay between the views of the two gentlemen who had spoken; but, for his own part, he thought the shareholders would be wise in leaving these matters in the hands of the Directors.

The motion was heartily agreed to.

The CHAIRMAN sincerely thanked the shareholders for their kind appreciation of the way the Directors had fulfilled their duties during the past year. He did not think it desirable to prolong the discussion of this very delicate subject of negotiations with the Italian Government. But he could say that the Company had respected the laws of contract; and they asked the Italian Government and the Municipalities with whom they dealt to do the same. It would not be a question of approaching the Government in a bellicose spirit. It would be a question, if it came to negotiation, to ask back what they had spent, and compensation for profits which they would receive in the future; and he believed the Italian Government, who had fulfilled their promises and undertakings in contracts in the past, would do so in the future. So far as the Italian Government was concerned, he thought himself that their expectations would be fulfilled. But he wished to say one word about municipalities. Municipalities changed; and, in the heat and struggle of political fights, they seemed to lose that sense of honour which, with the higher politicians, had through the past always been maintained. He could only hope the large cities in Italy with which they had to deal would take a leaf from the records of cities in other countries of Europe, and behave to companies who had fulfilled their contracts, in an upright, just, and equitable spirit.

This concluded the proceedings.

DOVER GAS-WORKS RECREATION-ROOM.

Anniversary Entertainment.

Readers of the "JOURNAL" are aware that one of the bonds of union existing between the Directors of the Dover Gas Company and the employees is the reading and recreation room, which, fifteen years ago, Mr. Raphael Herring, the Company's Resident Engineer, was able to establish, by the liberality and hearty co-operation of the Board. It had been a long-cherished idea; and its realization at Dover has not only been a source of gratification to Mr. Herring personally, but has resulted in strengthening the ties which bind workers and employers together in friendly relationship. On the 16th of December, 1887, the room was opened by the Chairman (Mr. Willsher Mannering), who from the outset has been a strong supporter of the scheme. In noticing the matter at the time, we cordially wished success to all who were engaged in the good work; and two years later we had the pleasure of recording that this had been assured. Since then there has been no falling off in the interest taken by the Directors in the movement, or of appreciativeness by the employees of the efforts made to render their lives happier by the provision of healthy recreation and instruction. To this end, among several valued gifts for the room are a billiard-table and accessories, by the Chairman; four large engravings and a handsome musical cabinet, by the Right Hon. G. Wyndham, the Chief Secretary for Ireland (the member for Dover); several pictures from the Directors, and from aldermen and councillors of the borough; games, and also a large framed portrait of himself, from Mr. R. Hesketh Jones; pictures, &c., from Mr. George Anderson; and several other gifts from Mr. T. N. Kirkham and local people interested in the room. Next to the portrait of the President (Mr. Herring), hangs a photograph of his gifted son, the Gas Engineer to the Edinburgh and Leith Corporations. The reading-room is supplied with five of the London daily newspapers, fourteen weekly periodicals (including such papers as the "Illustrated London News"), and nine of the best monthly magazines. In addition, there is a lending library containing 700 volumes. Games of all kinds are supplied, and refreshments provided; and these privileges are enjoyed for the nominal subscription of 1d per week. The recurrence of the anniversary of the inauguration of this excellent movement affords the men an opportunity for displaying their skill in decorating the room; and this year a special effort was made to make the room look gay, in commemoration of the Coronation. Last Friday, therefore, the occasion of the fifteenth of these annual gatherings, the assembled company, which included the Chairman and Directors, witnessed an unusual display. The President briefly reviewed the history of the room; and the healths of the Chairman and the President were enthusiastically drunk, with musical honours. The rest of the evening was devoted to a smoking concert, arranged by Mr. J. R. Wells; the proceedings terminating with the National Anthem. In further commemoration of the above-named national event and of the fifteenth anniversary of the opening of the room, all the members were photographed in groups, according to their ages, and each one was presented with a copy of one of the pictures, together with a framed portrait of the President. These will form exceedingly interesting mementos of the occasion which will be greatly prized by the recipients.

DEVONPORT GAS AND ELECTRIC WORKS EXTENSION.

The question of the extension of the gas-works was again brought before a meeting of the Devonport Town Council last Thursday. Since the matter was last discussed, a Sub-Committee of the Gas Committee had had it under consideration, and now recommended that the scheme (*ante*, p. 293) should be carried out in its entirety. Having regard to the report of the Gas Engineer and Manager (Mr. S. E. Stevenson) as to the increased consumption of gas, the Sub-Committee were of opinion that the extension ought to be proceeded with immediately; and this view was endorsed by the Gas Committee. Some members of the Council, however, opposed the scheme. Mr. R. H. Rendle contended that the amount proposed to be spent was excessive. Originally, he said, the cost was estimated at £55,000. It had now grown to £83,000, and, in his judgment, it would actually reach £100,000. How could the undertaking succeed if they overloaded it with capital? Mr. F. Allen also opposed the expenditure, and said that on the last occasion on which the subject was discussed they were assured that it would not be necessary to spend more than £20,000 in the next two or three years. Mr. M. Fredman thought caution was necessary in regard to large schemes of expenditure, for the Government were contemplating the erection of a large lighting plant of their own in the Dockyard, and this would deprive the Corporation of their best customer. Mr. H. Banbury said that the Council only agreed to the scheme on the distinct assurance that merely one-fourth of the £83,000 would be spent at present. Mr. J. Goodman was of opinion that more information should be given to the Council; but at the same time he believed it would be absurd to be frightened by an expenditure of £83,000. Those engaged in business were best able to judge of the need of extension. Mr. P. C. Goodman remarked that if they did not spend £83,000 they would have to lay out £20,000 on repairs which would not increase the productive power of the works.

The Gas Engineer and Manager reported that the Roads Committee had approved of Sugg's lanterns for the incandescent lighting of the streets, with double burners for the town and single burners for the suburbs. The cost of altering the lamps would be £2 6s. 6d. each, or a total of about £1962 for the entire borough.

The Electric Power Committee recommended the borrowing of £30,000 for the extension of the undertaking. Mr. G. H. Smith, jun., in moving the adoption of the report, said that £79,000 had already been borrowed for the purpose of the concern, and the expenditure had exceeded this amount by £6000. The outlay now proposed was necessary, and would be profitable. Alderman Littleton pointed out that the original estimate of the cost of the undertaking was £40,000; but it rose to £90,000, and now it was suggested to make it £120,000. Seeing that the Government proposed to establish electricity works in the Dockyard, he thought they should proceed with caution. Mr. Rendle moved, and Alderman James seconded, that the matter should be referred back to the Committee; the latter gentleman, as a previous Chairman of the Committee, remarked that some of the expenditure was contrary to his views. Mr. J. W. Spark, the Electrical Engineer, said the motive power was insufficient for the work. He did not know any plant where the strain was so severe as upon their own. Mr. J. L. K. Martyn thought the Chairman of the Electricity Committee and the Gas Committee should confer together, and ascertain what the Government really intended to do as to the lighting of the Dockyard. Mr. Smith, in reply, quoted figures to show that the capital expenditure on the Devonport electricity works was not so large as that of some other towns with a similar output. The recommendation of the Committee was adopted.

GAS ENRICHMENT BY BENZOL AT ARBROATH.

Enrichment of gas by means of benzol is now in operation at Arbroath, and with excellent results, as the following report shows.

The system of enriching Arbroath gas supply by the use of benzol has just been introduced by Mr. Young, the Manager, with what appears to be very satisfactory results. To avoid all risk of accident in the installation which has been fitted up by Mr. Young, the enricher, in its liquid state, is stored in a large tank underground, which has no communication with the upper air except by means of a tube for filling the tank and an air-shaft which is carried up the side of the adjacent building to the roof. A few yards removed from this underground tank, and in the rear of the offices, a small brick house has been built for the accommodation of the vapourizer and other plant. This building has no artificial means of lighting; and both by means of thorough ventilation and a system of check-valves, every precaution has been taken to avoid the risk of explosion or accidental ignition of either of the gases in the event of a leakage. The benzol is drawn from the tank by a small and double-action Worthington pump, operated by steam, and working at about 25 strokes per minute, and any excess of this is cut off by a sensitive governor. The liquid benzol is first pumped into a cylindrical tank, measuring about 4 feet high and 2 feet in diameter. The pipe connections to the tank are so arranged that when the pressure exceeds 30 lbs. the liquid is diverted back into the tank instead of being forced into the vaporizer. By this arrangement, should it happen that a larger quantity of benzol is pumped than the vapourizer can use, the excess liquor passes back to the under part of the tank and is repumped. The vaporizer is a considerably larger tank than the one before mentioned. It is heated by steam by means of a "jacket" at the bottom and top, as well as by several intersecting tubes similar to a tubular boiler. This vessel is kept at a temperature

to vaporize the benzol until it exerts a pressure of 30 lbs. to the square inch. When this is exceeded, as already explained, the supply of benzol automatically ceases until the pressure has fallen sufficiently to the point arranged. Having been converted into vapour, it is not at once introduced into a large volume of coal gas—experience having demonstrated that much better results are obtained by a gradual mixing of the richer gas. A small pipe has accordingly been taken off the main conductor before entering the holders, and carried up so as to form a junction with the enricher just as it leaves the vaporizer. This pipe is designed to carry from one-tenth to one-fifteenth of the total make of gas, and is so arranged that neither of the gases is forced into the company of the other; but by the time the coal gas and the enriching element reach the gasholder, they are in coalition, and mix freely with the larger body of coal gas in the holder. Mr. Young is at present using about 2 gallons of benzol to 15,000 cubic feet of gas; and he is confident that, without interfering with the year's estimates, he will be able to produce from one to two candles richer gas.

INCANDESCENT GAS LIGHTING FOR CHURCHES.

In the "JOURNAL" for the 2nd inst. (p. 1483), particulars were given of a successful installation of incandescent gas lighting at Christ Church, Scarborough; and we have since received information with regard to another equally satisfactory installation at St. John's Church, Stratford—one of several churches in the neighbourhood where incandescent gas lighting has been adopted. At the end of August, 195 flat-flame burners were replaced by 65 "Yotto" burners; the total cost, including burners, "Bonbac" mantles, alterations to fittings, &c., amounting to £22 10s. In the chancel, two clusters of nine flat flame burners were replaced by two clusters of three No. 3 "Yotto" burners, and four clusters of three flat-flame burners by four single No. 4 "Yotto" burners. In the nave, eleven ring pendants, each carrying fifteen flat-flame burners, made way for fifty-five No. 4 "Yotto" burners. The No. 4 "Yotto" burners are said (by the makers, the Wholesale Fittings Company, of Commercial Road, E.) to consume 3 cubic feet of gas per hour if used for lighting at maximum point. The change has been most striking; great brilliance having taken the place of a gloomy appearance. This, however, is not surprising, seeing that the candle power has been increased from 2340 to about 7560. The only fault which the Vicar is able to find with the new arrangement is, if we may say so, a good one—namely, that the light is excessively brilliant. It is stated that, during the three months the system has been in use, none of the "Bonbac" mantles have needed replacing.

ELECTRIC LIGHTING NOTES.

The Electrical Industry in Russia.

The St. Petersburg correspondent of the "Financial News" states that the Russian electrical factories of Messrs. Siemens and Halske, which work with a capital of 7,000,000 roubles, have closed their business year 1901-1902 with a net loss of 299,690 roubles, 60 per cent. of which must be put to the account of branches in Russia. Last year there was a dividend of 2¾ per cent. The report just to hand characterizes the present state of the electrical industry in Russia as extremely unsatisfactory, and states that no improvement can be expected unless greater facilities in the Russian customs and railway system are granted to the industry.

Failure of the Electric Light at Walsall.

Shortly after eight o'clock on the night of the 6th inst., Walsall was thrown into almost complete darkness in districts where the electric light was the chief illuminant, and particularly in the centre of the town, owing to a breakdown in the circuit. About the time that the irregularity arose, information was conveyed to the Police Station that a fire had broken out underneath the Imperial Hall, on premises used by the Corporation as an electric transformer station. The brigade turned out with the manual engine, and it was ascertained that a dynamo had become ignited. Fortunately, however, one of the men engaged at the station observed the mischief early, and extinguished the fire before the brigade arrived. Light failed for about a quarter-of-an-hour only; but during this period the greatest inconvenience was experienced. The mishap occurred just when tradespeople were busy, and many of them use the electric light.

Electricity by the Pennyworth.

At the meeting of the Sunderland Town Council last Wednesday, it was decided to try the penny-in-the-slot system for the supply of electricity. It appears that the Council have erected a number of workmen's dwellings, and it is the tenants of these who are to be catered for. The members of the Council viewed the matter from the point of view of pounds, shillings, and pence, and concluded that the experiment was likely to prove profitable. Though electricity has certain advantages, which recommend it in the case of clusters of buildings, such as the workmen's dwellings in question are, it is not so reliable or so convenient as gas; and the residents, it appears, will be without gas-stoves for cooking purposes, which otherwise would have been installed. A local paper considers that if the wish of prospective tenants had been consulted they would probably have preferred the older form of lighting. It is possible, too, that there may be some elements of danger associated with the new system, which will only be found out by experience.

Portsmouth in Darkness.

A few evenings ago, the sudden plunging of the office into darkness, and the concurrent cessation of the electrically driven linotype machines, gave the staff of the "Portsmouth Evening News" and "Hampshire Telegraph," the first intimation that something had gone wrong with the electric light supply. The telephone exchange was rung up in an endeavour to ascertain what was the matter; but the exchange was in darkness from a similar cause. This occasioned some confusion, on the clearing up of which it was found that the electric light station was already "engaged." The darkness lasted for nearly ten minutes, and then the lights went up again. Inquiries at the works at Portsmouth soon showed what had happened. There had been fusing from the dynamo at work, and the result was that the switchboard caught fire. The dynamo had to be stopped while the fire was put out and the other dynamo switched on; and this necessarily withdrew the supply of current from the whole town. Under the circumstances, the defect was very quickly remedied; but the inconvenience so generally caused without a moment's warning was, of course, considerable.

Electric Light too Dear for Wandsworth.

At a recent meeting of the Wandsworth Borough Council, the question of adopting electric lighting was under consideration. The County of London and Brush Provincial Electric Lighting Company had offered to supply current for all-night arc street lighting at 2d. per unit. The Lighting Committee of the Council had considered the offer, together with reports by the Surveyors on the subject. It was ascertained that the initial cost of each electric lamp, with column fixed complete, would be £19; and the annual cost of lighting (including the supply of current and the maintenance of the lamp), £18 10s. The Committee had made inquiries, and had come to the conclusion that the greatest distance between the lamps should be 70 yards. Taking these figures as a basis, they had compared the estimated cost of lighting with electricity one of the main thoroughfares in the borough with the present cost of lighting it with gas, and found that with electric light at 2d. per unit the cost would be three times as much as gas. Under these circumstances, they recommended that the Company should be informed that current at 2d. per unit was too dear, and that the Council did not see their way to adopt the light at present; but that if the cost should at any future time be reduced, the matter would be again considered. Mr. Lordon said he brought up the matter with a great deal of regret, because there had been a feeling in all the parishes forming the borough that at least the main streets should be lighted by electricity; but the Committee had come to the conclusion that, unless a further reduction was made, they could not advise the Council to adopt this illuminant. He would point out, however, that, sooner or later, they were bound to have electricity, and though he asked the Council to adopt the recommendation, he hoped they would not lose sight of the fact. The value of shop property in streets lighted with electricity went up, and consequently the rating was higher. Many authorities helped to pay for their electric lighting in this indirect way. Mr. Robinson moved an amendment to the effect that, notwithstanding the increased cost, the busier streets of the borough should be lighted by electricity. But it failed to find a seconder, and the recommendation was adopted.

Rhyl's Electric Light Undertaking.

A short time ago, Mr. R. H. Bicknell, M.Inst.C.E., one of the Inspectors of the Local Government Board, attended at the Town Hall, Rhyl, to hold an inquiry in regard to an application by the District Council for sanction to the borrowing of £9567 for the purposes of electric lighting. The Town Clerk (Mr. A. Rowlands) explained that the loan originally raised in connection with the undertaking amounted to £14,640, which was authorized last February; and the sum now applied for was money spent in excess. The Inspector characterized the proceeding as a most improper one. When the Council found the original grant was insufficient, Mr. Rowlands should, he said, have put the Council on the right side by at once making application for a further loan. Instead of doing this, they had gone on increasing their debt. The object of Local Government Board inquiries was not to consider applications for loans on money already laid out, but to ascertain how it was intended to spend the money applied for. Otherwise the whole inquiry was turned into a farce. Here was an instance where rather more than £14,000 had been borrowed, and the amount overspent by £9000. It was one of the largest excesses he had ever known; and he wished the Council to distinctly understand that it must not occur again. He should make the matter quite clear to the Local Government Board; and if any more expense of this kind occurred, it was doubtful whether any assistance would be given by that body. Mr. W. H. Trentham, the Consulting Electrical Engineer to the Council, was then examined; and he explained how the original estimate for the scheme—viz., £15,250—had been increased. The Inspector having remarked that it seemed an odd thing that the Council should ask for tenders for material and work other than that which they intended the first estimate to cover, Mr. Trentham went on to say that, in view of the demands arising in the town at the time, he suggested that it would be much better to go in for larger machinery at once than later on. They agreed to this suggestion, and the scheme was proceeded with. He then gave details as to the machinery, &c., according to which the actual cost was £3071 16s. 3d.—an increase on the original estimate of £1721 16s. 3d. Of this excess, £1250 was in a way accounted for; but the remaining £500 proved a stumbling-block to the inquiry—Mr. Trentham failing to bring up all the necessary figures. The Inspector said no doubt an endeavour had been made to produce an honest statement; but he really could not accept the one before him. Unless the inquiry was to be a farce, it was obvious that more figures must be forthcoming. He could not, try as he might, get to the bottom of that £500. A consultation took place; but as no one was in a position to help him out of his difficulty, Mr. Bicknell adjourned the inquiry till the 6th prox.

The Recent Prosecution at Taunton.

At the meeting of the Taunton Town Council last Tuesday, questions arising out of the recent prosecution of the Electrical Engineer were discussed at great length, and with considerable warmth. The Electric Light Committee presented a new form of agreement which they proposed to adopt for the supply of current to consumers in future. Great care, it was said, had been taken to make the conditions as explicit and favourable as possible, and the agreement, while protecting the Corporation, would compare favourably, from a consumer's point of view,

with the form adopted by other boroughs. A statement was then read by Mr. Thornhill, the defendant in the recent case, in which he explained the methods of working and registering adopted in connection with the supply of the electric light. He said the instructions he had given to the young man Witham were quite understood by him, and he well knew the expression, "Put on if on testing meter it appears to be slow." Witham was also well aware that the number of units he was instructed to put on were intended as a guide to the maximum amount which, in the absence of special circumstances, he should put on. Upon tabulating the results of Witham's reports, he found that quite 70 per cent. of the meters he had tested were correct, and were not altered, although in many cases the instructions given him were those he had admitted he construed as being directions to place a fraudulent reading upon the meter. Alderman Potter, Chairman of the Committee, while realizing the significance of the dismissal of the case against Mr. Thornhill, expressed regret, as did the Committee as a whole, that he did not have an opportunity of putting his version before the Court. He wished to contradict the statement made by Mr. Wansborough, the Solicitor for the prosecution, that within a period of six months a sum of £200 had been fraudulently obtained from consumers of electric light in consequence of overcharges. As a matter of fact, 20 per cent. of the meters were never touched, and instead of getting £200 in six months from extra charges, the amount received in nine months was only £37 3s. 7d. The Committee, he ventured to say, had not received a penny but what they were fairly entitled to as regarded the electric light meter charges, and certainly not designedly had there been a single unit put on more than it was believed had been consumed. There might have been mistakes and defects in their system in the past; but he had no hesitation in saying that, if the present agreement was accepted, every desire would be fulfilled, and it would leave no room for complaint. In the course of an animated discussion which followed, it was contended by one or two members that the Committee ought to have taken the Council into their confidence before; but the members of the Committee asserted that as soon as it became necessary they did so without a moment's loss of time. It was added that Mr. Thornhill had been the victim of a malicious prosecution. The report and the agreement were then accepted.

Leeds and the Ure Valley Water Scheme.—The minutes of the Water Committee which were adopted at the last meeting of the Leeds City Council included the acceptance of the tender of Mr. James Kaye for the construction of the Kettlesing and Swinsty tunnel for the sum of £73,742. It was stated that this was the beginning of expenditure upon permanent works in regard to the Ure Valley water supply scheme for Leeds. The work at present before them was the building of two reservoirs, in connection with which it was necessary to construct the tunnel in question. It was elicited that the highest tender for the work entrusted to Mr. Kaye amounted to £338,535.

LONDON COUNTY COUNCIL AND THE WATER QUESTION.

At the Meeting of the London County Council on Tuesday—Sir J. M'Dougall in the chair—the report of the Parliamentary Committee on the London Water Bill, briefly referred to in the "Journal" last week (p. 1528), was brought up. Dealing first with the rating proposals of the Bill, the Committee expressed the opinion that one of the principal advantages of the municipalization of water supply had been deliberately thrown away by them. Coming to the financial provisions, these were reviewed and criticized at some length; and then the Committee attacked the constitution of the Water Board. They concluded by stating that the various objections they had indicated were of such importance that they felt bound to advise the Council that, in the event of the Bill receiving the sanction of Parliament, it would be attended by results which they feared would prove prejudicial to the interests of the water consumers and ratepayers of London. They accordingly recommended the Council by resolution to express their opinion to this effect.

Mr. Harris said he was sorry the Committee had seen fit to push forward such a recommendation, because it could serve no useful purpose. It was only another example of the inability or unwillingness of the Council to face obvious facts. The situation at the present time was very simple. The Bill had passed through the Committee stage of the House of Commons, and was absolutely certain to be passed. Many of the objections raised in the report had been removed during the Committee stage.

Sir W. Collins pointed out that, in spite of all that might be said, the Bill had still to go to the House of Lords; and the Council had a duty to perform to the people of London. There would always remain the indisputable fact that there was no responsible and independent body who had ever examined into the question of whether a huge trust of 60 or 70 members was suitable to deal with the water question, who had not emphatically condemned it. He could be no party to the Bill; and he supported the Parliamentary Committee in washing their hands of the whole procedure. He should even have been glad if they had gone a little further, and asked the Government, who had given the Council so small and ridiculous a representation on the new body, to cut them out of the Bill altogether.

Mr. Beachcroft said that if Sir W. Collins were next day to repeat his last suggestion to Mr. Long, he might find a not unready acquiescence. The Council had lost the possibility of being the sole owners and managers of London water—a position for which they had been contending for the last eleven or twelve years. Unfortunately, the Council had allowed this rock to wreck their ship; for had they not split upon it, the water question would have been settled years ago. The Council, instead of going into the corner like children, should join hands in making the Bill a workable one.

Mr. M'Kinnon Wood declared that London, Middlesex, Kent, and

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1606.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	12½—13½	..	5 11 1
300,000	100	July 1	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 13	6½	Bombay, Ltd. . . .	5⅝—6	..	5 8 4
40,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 6
380,000	Stk.	Aug. 14	12	Brentford Consolidated	247—252	..	4 15 3
270,000	,,	,,	9	Do. New . . .	180—185	..	4 17 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	134—139	..	3 11 11
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb. .	110—113*	+1	3 10 10
220,000	Stk.	Sept. 11	10½	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7¾	Do. A. Ord. Stk. .	152—157	..	4 18 9
460,000	20	Sept. 26	10	British.	39½—40½	..	4 18 9
50,000	10	Aug. 14	12	Bromley, Ord. 10 p.c. .	22—24	..	5 0 0
82,850	10	,,	9	Do. 7 p.c. . . .	18—20	..	4 10 0
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd.	10—10½	..	6 13 4
250,000	Stk.	June 24	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
150,000	20	July 11	8½	Cagliari, Ltd. . . .	23—25	..	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	14⅛—15½	..	6 9 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
550,000	Stk.	Oct. 15	12½	Commercial Old Stock	250—260	−7½	4 16 2
251,875	,,	,,	9½	Do. New do. .	200—205	..	4 12 8
271,875	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	130—134*	+2½	3 7 2
800,000	Stk.	Dec. 11	8	Continental Union, Ltd.	133—138*	−1	5 15 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145*	+2	4 16 7
575,000	Stk.	Aug. 28	5⅝	Crystal Palace Ord. 5 p.c.	117—122	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120—125	..	4 0 0
106,158	,,	July 11	5	Do. 5 p.c. Deb. Stk.	139—142	..	3 10 5
486,090	10	July 30	10½	European, Ltd. . . .	18—19	+⅛	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Aug. 14	4	Gas-light and Coke	4 p.c. Ord. . .	84—85	..	4 13 0
2,600,000	,,	,,	3½		3½ p.c. max. .	87—89	..	3 18 8
3,799,735	,,	,,	4		4 p.c. Con. Pref.	110—112	..	3 11 5
4,193,975	,,	Dec. 11	3		3 p.c. Con. Deb.	91—93*	..	3 4 6
70,000	10	Oct. 30	8	Hongkong & China, Ltd.		14½—15½	..	5 3 3
3,800,000	Stk.	Nov. 13	10	Imperial Continental .		201—204	..	4 18 0
473,600	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.		99—101	..	3 9 4
561,000	Stk.	Aug. 28	10	Liverpool United A		223—225	..	4 8 11
718,100	,,	,,	7	Do. do. B .		165—167	..	4 3 10
306,083	,,	June 24	4	Do. do. Deb. Stk.		116—118	..	3 7 10
75,000	5	Dec. 11	5	Malta & Medn., Ltd. .		4—4⅛*	+⅛	5 11 1
560,000	100	Oct. 1	5	Met. of	5 p.c. Deb.	104—108	..	4 12 7
250,000	100	,,	4½	Melbourne	4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	Nov. 13	3½	Monte Video, Ltd. . .		9—10	..	7 0 0
1,515,892	Stk.	Aug. 8	4½	Newc'tle & G'tesh'd Con.		104—105	..	4 5 9
346,855	Stk.	July 4	3½	Do. 3½ p.c. Deb.		99—100	..	3 10 0
300,000c	Stk.	Nov. 27	8	Oriental, Ltd. . . .		140—145	..	5 10 4
60,000	5	Sept. 26	7	Ottoman, Ltd. . . .		6⅜—7	..	5 0 0
						* Ex div.	
851,070	10	Oct. 15	7	River Plate Ord. . .		10—10½	..	6 13 4
300,000	Stk.	June 24	4	Do. 4 p.c. Deb..		94—96	..	4 3 4
250,000	10	Sept. 26	8	San Paulo, Ltd.. . .		11⅝—12½	..	6 8 0
135,000	Stk.	Sept. 11	10	Sheffield A		236—238	..	4 4 0
209,984	,,	,,	10	Do. B		235—237	..	4 4 5
523,498	,,	,,	10	Do. C		234—236	..	4 4 9
6,000,000	Stk.	Aug. 14	5½	South Met., 4 p.c. Ord.		116—119	−1	4 9 6
1,700,000	,,	July 11	3	Do. 3 p.c. Deb. . .		91—93	..	3 4 6
380,940	Stk.	Nov. 13	5	Southampton Ord. . .		103—107	..	4 13 6
87,950	,,	July 11	4	Do. 4 p.c. Deb.		102—105	..	3 16 2
120,000	Stk.	Aug. 28	6	Tottenham and Edmonton	A. 5 p.c.	118—123	..	4 17 7
300,520	,,	,,	4½		B. 3½ p.c.	93—96	..	4 13 9
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .		8—9	+1	5 11 1
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.		96—98	..	5 2 0
230,000	5	Aug. 14	9½	West Ham, 10 p.c. . .		10—11	..	4 6 4
172,000	10	,,	6½	Do. 7 p.c. . .		13½—14½	..	4 9 8
				WATER COMPANIES.			
780,662	Stk.	June 24	11½	Chelsea, Ord. . .		320—330	+10	3 9 8
150,000	,,	,,	5	Do. 5 p.c. Pref. .		152—157	..	3 3 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75		140—145	+1	3 2 1
175,785	,,	Sept. 26	4½	Do. 4½ p.c. Deb. .		140—145	+3	3 2 1
1,720,560	Stk.	Oct. 15	8	East London, Ord.. .		230—240	+15½	3 6 8
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb. .		142—147*	+2½	3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb. .		96—98*	+⅛	3 1 3
700,000	50	Dec. 11	8	Grand Junction	10 p.c. max..	116—119*	+7	3 7 3
310,000	Stk.	Sept. 26	4		4 p.c. Deb..	125—130	..	3 1 7
708,000	Stk.	Aug. 14	14	Kent		300—310	+10	4 10 4
160,000	,,	,,	7	Do. New, 7 p.c. max..		200—210	+5	3 6 8
1,043,800	100	June 24	11	Lambeth, 10 p.c. max..		310—320	+14½	3 8 9
406,200	100	,,	8½	Do. 7½ p.c. max..		225—235	+10	3 8 2
350,000	Stk.	Sept. 26	4	Do. 4 p.c. Deb..		125—130	..	3 1 7
500,000	100	Aug. 14	12 5/16	New River, New Shares		395—405	+10	3 3 2
1,000,000	Stk.	July 30	4	Do. 4 p.c. Deb..		125—130	..	3 1 7
902,300	Stk.	Dec. 11	7	South-wark and Vauxhall	Ord. . . .	207—212*	+15½	3 6 0
126 500	100	,,	7		7½ p.c. max.	195—205*	+16	3 8 4
489,200	Stk.	,,	5		5 p.c. Pref.	151—154*	+⅛	3 4 11
1,019,585	,,	Oct. 15	4		4 p.c. A Deb.	125—130	+2	3 1 7
1,155,066	Stk.	Dec. 11	10	West Middlesex. . .		295—305*	+20	3 5 7
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .		140—145*	+3½	3 2
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb. .		97—99	+2	3 0 7
						* Ex div.	

Surrey all objected to the constitution of the proposed authority. He contended that the Bill was detrimental because they believed that the Board was not fitted to conduct the purchase of the water undertakings or to manage them after purchase. London had been put under great disadvantages by the Bill. Their greatest objection was that by a side issue the Government had succeeded in upsetting the whole system of London government, and causing friction and jealousy between the central and local authorities. The Bill was not being passed for the purpose of settling the water question, but of degrading and diminishing the importance of the Central Authority of London.

Mr. BURNS, M.P., said that, unsatisfactory as the present settlement of the water question might be in some details, it must be taken, not as the standard of what the Council desired, or of what ultimately they might be content with, but as the measure of what they had been able to force from a Conservative Government.

Mr. DICKINSON felt certain that the scheme of the Bill was a bad one; but the Moderate party on the Council were responsible for it, and its failure or success would be at their door. The institution of the new-fangled authority would be ruinous to the system of government in London. Before they consented to serve on the new body, they would have to very carefully consider their position. And if they stood aside, it would be in no sulky mood, but because they were proud and anxious to help the government of their city while it was constituted on a broad democratic basis, and could not be attracted by a system of government which was not in touch with the people.

After some further discussion, the recommendation was adopted by a majority of 51.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting of the Company was held at their Offices, Southwark Bridge Road, on the 9th inst., under the presidency of Alderman Sir HENRY EDMUND KNIGHT.

The SECRETARY (Mr. Montague Watts) having read the notice calling the meeting,

The CHAIRMAN proposed the adoption of the report and accounts (*ante*, p. 1569), remarking that all the observations he had to address to the proprietors on that occasion would show the prosperity, soundness, and the good prospects of their undertaking. Dealing with the accounts, he stated that the expenditure on capital account on works of the Company *per se* during the past half year had been only £17,000, or less by £13,750 than the outlay in the corresponding period of 1901. This was not brought about by the Directors having starved the expenditure on capital account, but because the Company were in such a splendid position, and were so much ahead of the requirements of their district, that the Board had been able to slacken off expenditure, and what remained to be done could be carried out in a comparatively leisurely manner. He might call attention to the fact that the capital account had been overspent by £9834; but they had not found it necessary at present to raise more money, because the Company had a large sum coming to them from the intercommunication account for the purchase of their works at Battersea. This amount would replace the deficiency in question, and leave sufficient working capital to go on with for a few months. In regard to the capital account relating to the intercommunication works, the expenditure during the half year had been no less than £165,000. They had been strongly urged to push these works forward as rapidly as possible in order thoroughly to ensure an undoubted water supply to the Metropolis. The great bulk of these works had fallen to the Company's lot to carry out; and to meet the desire mentioned, they had done all they could to push the works forward. The expenditure on capital account as regarded these works was in excess of the amount received by £58,875—that was to say, this was the sum by which the intercommunication works capital account was overdrawn at the date of making up the accounts. Since then, however, the Directors had issued £140,000 of intercommunication debenture stock. There was, therefore, in hand at the present time £81,000 for these works. But this amount would soon be used, as the works were fast approaching completion; and out of the £81,000 the Company had to be paid for their Battersea works. To finish the intercommunication scheme, it might be necessary to raise an additional amount—possibly about £50,000. The works would be completed and ready in every respect early in the ensuing year, possibly by March. As regarded their own Company, he might state that they had not wanted these works; but they had been advised to go into the intercommunication undertaking for the sake of the water supply of the Metropolis generally. They, however, had been placed in such a position that these works were of no consequence to them. They had a surplus of between 20 and 25 million gallons a day if it was wanted—in fact, they had been supplying one of the Companies with 10 million gallons a day. Passing to the revenue account, he stated that, under the head of maintenance, a saving had been effected on the whole of £1385 as compared with the September half of 1901. On maintenance and repairs, the expenditure was £592 less; while pumping and engine charges showed a reduction of £2476. On these two items, therefore, a saving of about £3000 had been effected. On account of rates and taxes, however, the Company had had to pay more in the past half year than in the corresponding period of 1901 by £2476, or exactly the amount, strange to say, which they had saved in the pumping and engine charges. The £1385 which he had mentioned would therefore have been about £4000 had it not been for the increase in the rates and taxes. Under the head of management, the total saving in expenses was £916. The stationery and printing charges had been £300 less; and law and parliamentary expenses showed a reduction of £943. Two or three items had been a little more; but, allowing for increases and decreases, a saving was shown in the management expenses, as he had said, of £916. He desired, however, to say a few words with regard to the reduction in the law and parliamentary

THE "ROSLIN"

No. 1109 £6 15s.

AN ARTISTIC AND HIGHLY FINISHED CONDENSING STOVE.

R. & A. MAIN, LTD.,

London & Glasgow.

expenses. The proprietors would have noticed that the accounts were not signed by the Government Auditor, and solely for one reason. The Company's expenses in the House of Commons in opposing the Purchase Bill and getting it amended as successfully as it had been came to £1748; and there were other items, amounting to £188, which the Directors had not been in a position to allocate at once—the two sums making together £1936. Mr. Stoneham wanted this amount brought into the past half-year's accounts; but the Directors stated that they would not consent to this, because it was doubtful whether the Company ought to pay it or not. It was a fair claim to make that the expense incurred in opposing the Bill should be paid by the purchasing authority; it had no right, the Directors maintained, to come out of the proprietors' pockets. They also thought that they were warranted in this conclusion by the way in which the matter was referred to in the Bill before the House of Commons. If the amount had been brought into the accounts as Mr. Stoneham had wanted, the Company's law and parliamentary expenses would have been considerably increased as compared with the sum shown in the corresponding period of the previous year; and he thought that the proprietors would agree with the Board in the position they had taken up—viz., that, there being a doubt, the amount ought to be held in suspense until the doubt was settled. On this point the Directors differed from Mr. Stoneham, who therefore would not sign the accounts. He told the Government Auditor that the Directors would take care to carry forward a sufficient amount out of the profits to pay the expenses in question if it were decided that the Company had to pay them. The water-rents accrued to the date of the accounts were £160,506, showing a deficiency of £4484 compared with the figures for the corresponding period of 1901. On the face of it, and without an explanation, this would seem to show that the Company had gone back; but this was not so. The fact was that in the September half of 1901 they supplied the East London Company with water, for which they received £16,000; whereas last year they received only £8835 from that Company for water. They therefore received from this one unusual customer £7185 less; whereas the apparent deficiency shown in the water-rents accrued was only £4484. These figures really meant that there had been an increase of £2701 in the Company's normal business in the half year under review. Moreover, the £4484 was reduced, by the savings in maintenance and management expenses, to £2183. Adding £500 less for losses, the amount arrived at was £2683, or exactly the difference between the £85,857 carried this time to dividend and interest account and the £88,453 carried to that account a year ago. The balance applicable to dividend was £43,357, or £3448 less than at the corresponding period of last year, although, as he had said, they had received £7000 less from the East London Company. The Directors were enabled to pay a dividend of 7 per cent. per annum, which would absorb £36,000, and leave £7357 to be carried forward. With regard to the prospects of the Company, he never knew them to be brighter; and if they could only have been left alone for three or four years, he believed that they would have been able to pay the full dividend, as well as the arrears on account of former dividends. They had nearly come to the end of their expenditure; and when the works which had yet to be completed were finished, the concern would be so thoroughly "tiled in," that for the next forty years there would be nothing before the Company in the way of expense, and their prosperity would continue to increase substantially. They would thus have reaped the reward for the heavy labours which had fallen on them in the last twenty years; but it appeared that just as the fruit had ripened, someone else was to pluck it. The Directors would, however, take care to do their best to see that all these matters were taken into consideration; and they would endeavour before the Arbitrator to see that the Company were fairly treated. He was sorry that the East London Company had not yet got their storage reservoirs completed; and the Company were therefore supplying them with a large quantity of water. This would give them an important asset to deal with in their next balance-sheet. Dealing with the report, he stated that for the £140,000 of intercommunication debenture stock which the Directors offered, applications were received for £623,000—a circumstance which looked as if the Company's credit was very good. The price of issue was also over 96. As the proprietors were aware, the London Water Bill had passed through Committee, and it would, as it stood, very soon assume the form of an Act of Parliament. He thought that, in touching this question at all, and in giving way to the clamour of a very small body of people, Parliament had made a great mistake. The transfer of the undertakings of the Companies had not been asked for by the inhabitants of the Metropolis, from whom he did not hesitate to say that a loud groan would shortly be heard on account of the largely increased amount they would have to pay for their water. In addition to what he had stated, the Company had two very valuable assets in the wells which they had sunk at Honor Oak and Merton, and which had turned out beyond the most sanguine expectations. The quantity of water proved to be there was so great that the Directors had ordered the permanent pumping machinery and buildings to be erected with all possible speed; and he thought the amount which would be obtained from these wells would very materially lessen that which would have to be taken from the Thames for the supply of the district.

Mr. C. M. VIALLS seconded the motion, and it was carried

Resolutions were afterwards passed approving the dividend mentioned and re-electing the retiring Directors (Alderman Sir H. E. Knight, Sir R. H. Wyatt, and Mr. V. B. Tritton) and the retiring Auditor (Mr. John D. A. Norris).

An Extraordinary General Meeting was held subsequently, when the following resolution was passed:—

That the further amount required for intercommunication works, under the provisions of the Metropolis Water Act, 1899, be raised by the Directors by the creation and issue of such intercommunication debenture stock, on such terms and conditions, and at such times and in such manner, consistent with the said Act, as the Directors may from time to time deem expedient.

The usual votes of thanks terminated the proceedings.

THIS IS THE WEATHER TO HIRE OUT

"Eureka"

Gas-Fires.

JOHN WRIGHT & Co.,
Essex Works,
Birmingham.

JOHN WRIGHT & Co.,
Essex Works,
Birmingham.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at their Office, South Molton Street, on the 10th inst.—Mr. FREDERICK TENDRON, F.G.S., presiding.

The SECRETARY (Mr. J. Goodwin) having read the notice calling the meeting,

The CHAIRMAN proposed the adoption of the report and accounts, remarking that the shareholders must have studied the figures submitted to them with some satisfaction. There had been a large increase in the water-rents, which showed an advance of £4355 over the amount received for the corresponding period of 1901. The increase in the supplies during the past half year was 1428—a number which, he thought, was far in excess of that which the Company had ever previously had in a single half year. It took some little time for the full benefit of a new supply to be obtained. Not only must a certain period elapse before it came into operation, but in many cases of new supplies pipes were laid down for a few houses in newly constructed roads in which the houses joined on only gradually. This was all-important to the Company, as showing the increase in their country district. But the growth in their London district was equally important; and they clearly proved, before Lord Llandaff's Commission, that the improved revenue from the latter had not arisen from the quinquennial assessments, but that it was owing to the erection of superior buildings where old houses had been pulled down. The revenue account showed that £2000 had been charged for parliamentary expenses. This meant a portion of the amount, or, as far as could be estimated, the amount which the Company might have to pay for the expenses incurred by them in connection with the Government Water Bill. They might possibly have the right to claim this £2000 back from the Water Board. In regard to this question, he saw that the Directors of the Southwark and Vauxhall Company took up a strong position, and refused to consider these expenses a revenue charge; and he believed that Mr. Stoneham, the Government Auditor, taking a different view, had refused to sign their accounts. In the case of their own Company, the Directors had passed the £2000 in a form which had satisfied the Government Auditor, though there was another matter which Mr. Stoneham might or might not be satisfied with. This, however, was a point on which the Board must exercise their own judgment, and rely upon the shareholders to support them in their view; he referred to the sum which they must sooner or later provide as a contingency fund. No less than £6320 was charged in the accounts for the Company's proportion of the expenses of the Staines Reservoirs Joint Committee; this amount being almost entirely for interest upon the debenture stock raised by the Committee to pay for the works. But this sum only carried them up to June 30, and the Directors were aware that when the accounts were brought to a fixed date they would have to provide for another quarter at Staines. It was therefore right and desirable that provision should be made for this; and he supposed that a fair provision would be about £3500. The accounts also brought in a quarter's rental that was due; but as the money was not collected—or, at all events, the greater part of it—the collectors'-commission was not debited, although it was a fair charge on this rental. A sufficient amount must therefore be put to the contingency fund to cover this item; and there was a small payment of a similar kind to the Thames Conservancy. Something might also have to be furnished on account of rates and taxes. The whole sum which had thus to be provided was about £5000; but he objected most strongly to this being charged to any half year. It could not be right to bring nine months' Staines charges against any particular half year; and, therefore, as it was a charge against several former half years, the Directors would take the amount out of the balance carried forward—they would take £5000 from the balance, and place it to a contingency fund to meet the liabilities in question when they had to be dealt with, which he supposed would be at the time when the Companies were taken over. Nothing was charged in the accounts for the costs in connection with the quinquennial valuation; but £2700 had previously been charged on this head. The Directors had not charged anything this half year—not because they did not think that there was more to come, but because they thought that it was fair to charge the cost of fighting the quinquennial valuation over the five years, just the same as the benefit to be derived by the Company would be spread over the five years. Their parliamentary year ended on Sept. 30 last; and during that period the increase in their ordinary rental, as compared with that of the previous year, was no less than £9085, quite apart from any small increase of rental which they might have had from the East London Company. Leaving out Staines, the profit for the twelve months was over 10 per cent.; and for the first time he could congratulate the shareholders on belonging to an actual 10 per cent. earning Company. The Directors had often led them to expect that this time would come, and it had come at last. In 1899, the net earnings of the Company—leaving out Staines—were 9·24 per cent.; in 1900, they were 9·40 per cent.; in 1901, they were 9·90 per cent.; and for this year, they were 10·04 per cent. During these years, the Company paid on account of Staines £33,404, and increased their undivided balance by £28,759; making £62,163 earned for, but not paid to, the shareholders. They would therefore quite understand that the dividend received during this time was not the indication of the value of the property as the Directors would place it before the Arbitrators. The value of the Company's property was its earning power, and Staines would not enter in the least into the calculation before the Arbitrators. The payments made by the Company on account of Staines were, in truth, capital expenditure. The new Water Board would take over the Staines works, and they would have had to complete them if they had not been completed. In that case, they would have had to pay the interest; and therefore it could only be right that, when they took the works over, they should reimburse the Company the money paid by the latter during these years for interest and for the management of the reservoirs. There was a difficulty at first in getting this view accepted; but it seemed to have gained

GASHOLDERS WITH GUIDE-FRAMING, OR SPIRAL GUIDES ONLY.

PURIFIERS WATER LUTES OR LUTELESS, WITH SPECIAL RUBBER JOINT

MILBOURNE'S PATENT LUTELESS PURIFIERS.

WECK'S PATENT CENTRE-VALVE.

WATER - CONDENSERS - ATMOSPHERIC.

Milbourne's Patent Grid Valve. Cripp's Patent Grid Valve.

VALVES. See the new Edition of Walker's Catalogue.

SULPHATE AND SULPHUR PLANTS. TAR-DISTILLING PLANTS.

SIEVES. SELF-SEALING MOUTHPIECES. TAR-BURNERS.

C. & W. WALKER, Ltd.,

Midland Iron-Works, Donnington, nr. Newport, Shropshire.

110 CANNON STREET, LONDON, E.C.

Telegraphic Addresses: "FORTRESS, DONNINGTON, SALOP." "FORTRESS, LONDON."
Codes used A.B.C. and "A1."
Telephone No. 12, WELLINGTON, SALOP.

ground very strongly, and he had a firmer faith than he had ever had before that, without the fight which he had thought might be necessary, this view would be recognized in the arbitration, as it had been in the Water Bill. With reference to this measure, he desired the shareholders to know what his interpretation of it was as it affected their undertaking. He wished them, however, to understand that he was simply expressing his own opinion, which might be in accordance with that of his colleagues on the Board, although there might be some slight disagreement among them regarding it. With respect to the debenture stockholders, he did not think that they had anything to complain of in having the privilege of their irredeemable stock taken from them, because the stock they would receive in exchange could not be redeemed in less than sixty years. This was so long a period that he thought they had every reason to be satisfied, as they would have the same income as before, the same security, and, in addition, the security of the rates of London. With reference to the ordinary stockholders, they would receive cash if they did not wish to take water stock, or if the Water Board did not wish to give them the option of having such stock. The Directors had always fought for the principle of the Lands Clauses Act; and in the House of Commons Mr. Long [from whose speech he quoted] had stated that this principle was to apply, although there would be no fixed 10 per cent. charge for the compulsory purchase of the works. What he (the Chairman) had said dealt with the debenture stockholders and the ordinary stockholders; but he had now to come to another class. The holders of the 7 per cent., the 7½ per cent., and the maximum 10 per cent., shares were all ordinary shareholders; and what he objected to most strongly in the Bill, and always had objected to, was the possibility of any Company having to part with their property before the award was given. It was true that the day had been postponed—it was now fixed for June 24, 1904—and power was given to the Local Government Board to, he should say, extend that date. But reading the clause as a layman, he did not like its wording. It said that the appointed day meant June 24, 1904, "or such other day as the Local Government Board may appoint." But there was nothing to prevent an earlier day from being appointed. He did not wish them, in such a matter as this, to be dependent on any President of the Local Government Board, even on Mr. Long, however high his opinion might be with regard to the rights of property. It was to be remembered that there might be a repetition of what occurred before, and there might be a President of the Local Government Board such as there was formerly; and did the proprietors think that such a man would have any respect for the Water Companies? Let them look at the condition of mind of the London County Council. If there should be a repetition of what formerly happened, the result might be most serious for the Water Companies. He maintained that it ought to be made perfectly clear that, except by the consent of the Companies, the date should not be made earlier than that named. He contended, moreover, that this question ought to be left in the hands of the Arbitrators. The latter would be men of judgment, and in the event of any difficulty arising they would know whether the Water Board or the Companies were responsible. They would then be able to fix the date, and, if they thought proper, not allow any Company's property to be taken over until they had given their award. Before the matter was finally settled, he hoped that the House of Lords would make the change he had suggested, and give the power in question to the Arbitrators instead of to the Local Government Board. As far as their Company were concerned, the Directors would go before the Arbitrators with absolute confidence. They had good figures to put before them; they had not been dividing up to the hilt, but had put money by. All the Company's works would be in good order, and the power for them would be far in excess of what was necessary at present. They also had a supply which was in excess, and which for years to come would be in excess, of their requirements. Lastly, by their economy and foresight, they, in conjunction with other Companies, had provided a magnificent reserve at Staines, sufficient for their requirements for 35 or 40 years. He therefore repeated that the Directors would go with confidence before the Arbitrators.

Mr. FRANCIS TAGART seconded the motion, and it was carried.

The CHAIRMAN afterwards proposed the payment of the dividends mentioned for the last financial half year—at the rate of 8 per cent. per annum on the £50 "A" and the £25 "B" shares, 7½ per cent. per annum on the £25 "C" shares, and 7 per cent. per annum on the £50 "D" shares.

Mr. WEBSTER seconded the motion, and it was carried unanimously.

Mr. I. A. CROOKENDEN afterwards proposed a vote of thanks to the Chairman, Directors, and officers, for their able management of the Company's affairs in the past half year. He said there could be no doubt that the intention of the amended clause to which the Chairman had alluded was that the Local Government Board should appoint a subsequent, and not an earlier, date than that named for taking over the properties; and he thought that the objection raised by the Chairman might be met by putting in the clause the word "subsequent" in place of the word "other." Of course, this would not affect the Chairman's argument against the taking over of the properties before the award was settled. This was a suggestion made by the London County Council; and there was no doubt that it was unprecedented to take over property before its value had been settled by the arbitrators and the latter had given their award.

Mr. WRIGHT seconded the motion, which was carried unanimously.

The CHAIRMAN, in reply, after acknowledging the vote, said he quite agreed with what Mr. Crookenden had said, that the intention was that the date of taking the Companies over should be subsequent to that mentioned; but Acts of Parliament were frequently not read in the light of what was intended by them when they were passed, but in the light of the words used. Before, therefore, it was too late, he would like to see the word "subsequent" introduced; and, as he had said, he would also like the power of extending the date to be left to the Arbitrators instead of to the Local Government Board.

The proceedings then terminated.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN	1,000,000
PERNAMBUCO (Brazil)	125,000
MALTON	150,000
DULUTH, MINN. (Second Contract)	300,000
BROCKVILLE (ONT.)	250,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.), 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft. TORONTO (3rd Cont.), 750,000 C. Ft.

DAMAGE TO A RESERVOIR AT MERTHYR.

Dynamite or Lightning.

A Meeting of the Merthyr Water-Works Committee was held last Wednesday, when the Surveyor (Mr. T. F. Harvey) presented a statement regarding some damage which had been done to the cast-iron diaphragm plates at the Upper Neuadd reservoir. Mr. G. F. Deacon, M Inst.C.E., who had visited the reservoir for the purpose of inspecting the fractured plates, said he was unable to find any evidence of the damage having been occasioned by water pressure; and it appeared to him that the cause was more probably dynamite (or its equivalent) or lightning. He was not inclined to believe it was dynamite, because he was reluctant to think anybody would do such a thing; and he thought it was unlikely that the preparations which would have to be made in such an event could have been made. Therefore he was more inclined to adopt the lightning theory. The iron plates were practically in a state of insulation. A lightning conductor had now been fixed; and he did not think such an occurrence was likely to take place again. Replying to Mr. David Evans, Mr. Deacon stated that the damage to the fractured plates was star-like in several different places, such as might have been produced by several charges of dynamite or lightning. After further discussion, Mr. Deacon said they had better get the broken plates taken out as soon as possible. The value of the whole of those plates was £65. It was resolved unanimously that steps be taken to provide new plates and connect them up with the lightning conductor. Mr. Deacon, replying to Mr. H. W. Martin, said he had not seen any flaws in the broken plates. He thought if a string of dynamite had been let down and fired, it would have produced such an effect. Mr. H. W. Martin: Suppose they killed fish, how would they get them up? The Chairman: The fish would rise to the surface, and then they could be got out with a net. Mr. J. Harper asked if the place could not be properly protected; and it was left to Mr. Deacon to see to the desirability of doing something to prevent people getting near the ironwork. It was stated that the repairs to the damaged plates would probably be effected in three or four weeks.

The "Detroit Free Press" says: "It seems to be the purpose of the newer Trade Unionism not to win over the non-Union labourer, but to destroy him. Nobody must work with him, nobody must employ him, nobody must sell him the necessaries of life, nobody must associate with him, nobody must even defend him when his cause is just and his right clearly established. He is something unclean, which in Trade Union ethics any man has a right to destroy. In the common law of Trade Unionism, the non-Union labourer is the *fera natura* of civilization—the wild thing that may be destroyed at pleasure wherever found."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A new retort-house, with modern appliances, was inaugurated in the Broughty Ferry Corporation Gas-Works on the evening of Monday last. On account of the large number of gas cookers and heaters in use, the consumption of gas has increased very much of late years. Last winter, the output was nearly double the quantity for which the retort-house had been designed. A new building was therefore erected on the site of a coal-store; and in it has been constructed a bench of 32 retorts, in four ovens of eight each. The retorts are 13 ft. 6 in. in length. They are fired by the regenerative method for which the Manager at Broughty Ferry (Mr. Forbes Waddell) and his brother, Mr. A. Waddell, of Dunfermline, hold patent rights. By this system, there is said to be a saving of 25 per cent. in the quantity of coke required to heat the setting. It was only last spring that the patent was brought out; and already, it is reported, it has been adopted in 16 gas-works in the United Kingdom. The charging and drawing are done by West's manual machinery. A coal and coke conveyor has been introduced, as well as sorting plant for the coke. The coal and coke handling machinery has been designed by Mr. Waddell, and erected by his own workmen. In the same house with the retort-bench are two Babcock and Wilcox boilers, which are fired by coke breeze, and which provide steam for both the gas-works and the electric lighting station. A chimney, 120 feet in height, serves both the boilers and the retort-bench. At the close of the Council meeting on Monday, the members visited the gas-works. Mr. Waddell explained the working of the plant to them; and the conveyor was started. Everything was found to work very satisfactorily, and Mr. Waddell was complimented upon the success of his work.

This week the Arbroath Town Council have had before them several matters connected with the town gas supply. The Manager (Mr. A. C. Young) reported that several complaints had been received with reference to variation in the light given by incandescent lamps. He had, in consequence, tested the pressure in the mains in various districts in the town; and he had arrived at the conclusion that the governor at the gas-works was too small. He considered that, in the meantime, by turning on the bye-pass at the governor, the required pressure could be obtained, which would not entail any cost to the Corporation. It this were approved of as a temporary arrangement, he would recommend that a new governor be put in next summer. The probable cost would be £160. But the mains in various parts of the town were now too small; and he suggested that new and larger mains be laid in a number of streets, the old pipes to be taken out, as they were a fruitful source of leakage on account of faulty connections with service-pipes. The last occasion on which a report as to the pressure on street-mains was made was in 1892, at which time the gas

The

"Parkinson" Cooker

CROWN PATTERN.

PARKINSON AND W. & B. COWAN, LTD.,
LONDON, EDINBURGH, BIRMINGHAM,
MANCHESTER, SYDNEY, N.S.W.

manufactured amounted to 46,470,500 cubic feet. At present the gas produced annually reaches about 68 million cubic feet—an increase of nearly 50 per cent.—and the growth appeared to be continuing at the rate of some 2 million cubic feet a year. Nothing, however, had been done in the way of having larger mains since 1892. The Gas Committee, after considering the Manager's report, approved of it, but deferred coming to a final decision till near the close of the financial year. The work of renewing one of the mains is, however, to be undertaken at once.

The Board of Trade several months ago wrote asking what was being done by the Arbroath Corporation under their Electric Lighting Order; and the Committee recommended that the Town Clerk be authorized to reply that, partly owing to the existing depression in trade in the town, but more particularly on account of their having been obliged to take up the question of a gravitation water supply for the burgh, the Council deemed it inadvisable to carry out, in the meantime, the Electric Lighting Order, and that they desired the Board of Trade to allow the Order to remain in force until the water supply had been dealt with. On the motion of Provost Grant, this was agreed to. The electric light is to be made to stand over, if the Board of Trade consent, until the burgh sees better days. It is doubtful, however, whether the consent will be given, even if it can, as there are two firms of electricians who are desirous of being entrusted with the work of fitting up an electric installation in the town.

At a meeting of Kilsyth Gas Commissioners on Monday, it was reported that an agreement with the Railway Companies for the construction of a siding into the gas-works had been completed. Provost Wilson said that during the last few weeks the gas had not been of good quality, and that complaints were very numerous. The Manager (Mr. W. Kellock) explained that during all the previous week they had been taxed to the utmost, and had no pressure; and he said that on the Saturday evening both gasholders were completely empty, He had now, however, started another oven, and he would be able to keep the supply going and the pressure up.

The Gas Committee of the Falkirk Town Council last Tuesday night had before them replies from the proprietors of the properties it is proposed to purchase in the neighbourhood of the existing gas-works, with a view to obtaining temporary relief. The answers were to the effect that the properties could be bought on compulsory purchase conditions. Only one mentioned a price for his portion—about £1000. This unfavourable reply led to a motion for the appointment of another Committee, with Provost Weir as Convener, to consider the subject, and the entire gas question as well. It was proposed that Mr. H. Russell, the Convener of the Gas Committee, should be excluded from this new Committee; but he insisted that, as they were to consider the whole gas question, he should be a member of it. After a long discussion, it was agreed to put Mr. Russell on the Committee. The movement, it appears to me, is simply a covering of the retreat of the Provost's party, for they have no power whatever to purchase any properties by arbitration.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 13.

Sulphate of Ammonia.

The week opened with a strong market, and there being keen competition for parcels offered extreme prices were paid in urgent cases, and values advanced all round. Scotland was the scene of greatest activity, the large forward business done there having doubtless stimulated greater interest elsewhere. At the close the tone is rather quieter, though quotations are £11 16s. 3d. per ton f.o.b. Hull, and £11 18s. 9d. to £12 per ton f.o.b. Liverpool and Leith. £12 per ton, ordinary terms, having repeatedly been paid f.o.b. Leith for January-June delivery, makers advanced their prices to £12 2s. 6d. per ton, but buyers refused to follow.

Nitrate of Soda.

This has also been largely dealt in in the forward position, but an advance of 3d. per cwt. demanded by sellers has been sufficient to stifle interest in that article also. Spot prices have been advanced to 9s. per cwt. for ordinary quality, and to 9s. 3d. per cwt. for refined.

LONDON, *Dec.* 13.

Tar Products.

There is nothing fresh to report; prices as a rule remaining about the same as reported last week. The demand for benzol continues fairly good, and further sales of 90 per cent. are reported for home consumption. In 50-90 per cent., there is a good inquiry from the Continent for January-June delivery; but sellers do not care to contract except at a considerable improvement on existing values. Toluol is again quiet; and although prices have not been reduced yet, the demand appears to have fallen off for the time being. Crude carbolic is decidedly easier. There is a good deal offering in the market, and consumers show a tendency to reduce their limits, especially for early delivery. In crystals, there is a little business doing in 34 35's at under 5d. per lb., which price has been accepted in several instances. Creosote continues very firm, especially in London; but in the provinces there does not seem to be quite such a good demand for prompt delivery, and, if anything, prices are a shade easier. The market for solvent remains dull. Business is very limited, and purely for home consumption. In pitch, there are a good many inquiries, but principally for early delivery. Prices are firm, as the demand for home consumption is strong. As regards next year, however, there is not such a large demand; and it remains to be seen whether the fuel makers will continue to contract forward at existing high prices.

The average values during the week were: Tar, 21s. to 26s. Pitch, London, 56s. 6d. to 58s.; east coast, 54s. 6d. to 55s. 6d.; west coast, 53s. to 53s. 6d. Benzol, 90 per cent., 9½d. to 10d.; 50-90 per cent., 8¼d. to 8½d. Toluol, 8d. Crude naphtha, 3¼d.; solvent naphtha, 8½d. to 9½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1⅜d.; North, 1⅛d. to

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER **100** MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

1½d. Heavy oils, 2d. to 2¼d. Carbolic acid, 60 per cent., 1s. 8d. Naphthalene, 35s. to 55s.; salts, 23s. 6d. to 26s. 6d. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market closes very firm, with a specially strong demand for forward delivery. The Gaslight and Coke Company will not offer in any position, but are reported to have declined £12 for January-April. The actual value for December delivery, on Beckton terms, may be taken as £11 17s. 6d. Another London Gas Company is reported to have refused £11 17s. 6d. for December, but would sell some quantity at £12. In Hull, business has been done at £11 15s. for December; but makers will not offer forward, except at a considerable advance in value. In Leith, there are buyers for January-June at £12; but for prompt, £11 17s. 6d. to £11 18s. 9d. has been paid in several instances. The Liverpool market is fairly steady, and sales are reported at £11 16s. 3d. prompt shipment. The outlook forward is evidently very good, as is proved by the fact that higher prices are asked for January-June; but for prompt, the demand is not quite so strong.

COAL TRADE REPORTS.

Lancashire Coal Trade.

A fairly active business is just now passing through in the coal trade of this district, which is keeping collieries generally running practically full time, and, except in some of the very inferior sorts of fuel, taking away all the present output. The chief briskness of inquiry is for the better qualities of round coal suitable for house-fire purposes. For these descriptions, prices are strong at the full list rates; but there is no indication of any upward movement. At the pit, best Wigan Arley coals average 15s. to 15s. 6d. per ton, seconds Arley and Pemberton four feet 12s. 6d. to 13s. 6d. and 14s., and common house-fire coals 10s. to 11s. and 11s. 6d. The requirements for steam, forge, and general manufacturing purposes continue but indifferent; the extra demand upon the lower descriptions of round coal suitable for common house-fire purposes is, however, tending to steady the market, and good ordinary descriptions of steam and forge coal are scarcely quoted under 8s. 6d. to 9s. per ton at the pit mouth. Occasional orders just now coming upon the market for supplementary supplies of gas coals have also to be placed on the basis of the full contract rates, representing about 9s. to 9s. 3d. per ton at the pit for Wigan four feet screened gas coal, and 10s. to 10s. 3d. for the best screened Arley. A stronger tone is maintained in the better qualities of slack, which are mostly meeting with a ready sale. Inferior sorts continue plentiful, with prices here and there cut very low. At the pit, best slack is firm at 6s. 6d. up to 7s. per ton, medium 5s. 3d. to 5s. 9d., and common quoted about 4s. 3d. to 4s. 9d.

Northern Coal Trade.

The chief feature in the coal trade of the North is the strong demand for gas coal, which is at the present keener than that of any other kind. In the steam coal trade, some additional orders for the United States have been booked; and these help to keep the collieries better employed than is usual at this season. Best Northumbrian steam coals are from 11s. 3d. to 13s. 6d. per ton f.o.b. Second-class steams are from 10s. to 10s. 6d., and steam smalls are 5s. 3d. to 5s. 6d. The gas coal trade is at the height of the demand; and where there is any quantity for sale beyond the large contracts that are being taken, the price asked is high for delivery over the next four or five weeks. The general price is from 10s. to 10s. 6d. per ton f.o.b. for prompt delivery; while for forward contract the price is about 9s., though it is dependent on the duration of the contract. Gas coke is now more plentiful; but the price is rather irregular, the exports being now naturally more limited. As high as 14s. per ton f.o.b. is quoted for this year's delivery; next year's price being less.

Scotch Coal Trade.

There is no slackening in the demand for coal for manufacturing purposes; and the cold weather has made coal for domestic purposes in greater request. The output is thus being taken up. It is generally understood, however, that the demand is of the current order, and that there is little forward contracting in existence. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. 3d. to 11s. 3d., and splint 11s. to 11s. 6d. The shipments for the week amounted to 222,073 tons—a decrease of 23,121 tons upon the preceding week, but an increase of 31,838 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,621,305 tons—an increase of 1,308,579 tons upon the same period of last year.

Trade Unions in 1901.—The report by the Chief Labour Correspondent of the Board of Trade (Mr. John Burnett) on the above subject has been published as a parliamentary paper. In the course thereof, he states that there was but a slight addition to the numerical strength of Trade Unions in 1901; the total membership of all Unions at the end of the year amounting to 1,922,780, or only 12,166 in excess of the total at the end of 1900. Of the 1236 Unions in existence at the end of 1901, less than half—namely, 589—were registered; but these contained 1,503,415 members, or nearly 80 per cent. of the total membership of all the Unions. Though a number of large Unions remain unregistered, the average membership of those registered is about four times as great as that of the unregistered. Among the 1,922,780 members of Unions are included 120,078 women and girls, or about 6·2 per cent. of the total. The income of the 100 principal Unions last year was £2,062,000, or nearly £100,000 more than in 1900. The expenditure also shows an increase—namely, from £1,475,000 to £1,656,000. The accumulated funds of these societies now stand at £4,161,916, or about £400,000 more than at the end of 1900, and nearly a million more than in 1899.

MODERN

LUTELESS PURIFIERS,

PICKERING'S PATENT,

SAVE CONNECTIONS.

REQUIRE LEAST SPACE.

WILLEY & CO.,

LONDON & EXETER

Strange Accident to a Gas-Meter.—A curious accident is reported to have occurred to a gas-meter in a house at East Twickenham. A servant had been to the coal cellar and taken with her a candle (which she placed, alight, on the stairs), and had then returned to the dining room with some coals. On going back, she saw a big flame on the cellar stairs. It afterwards transpired that the gas meter had fallen with its bracket while she was away; and the pipe having broken, the escaping gas became ignited.

The New Gas-Works for Coventry.—The Gas Committee of the Coventry Corporation reported to the Town Council last Tuesday that tenders for the construction of two gasholder tanks at Foleshill, in accordance with the specification recently prepared by the Engineer and Manager (Mr. Fletcher W. Stevenson), and for the supply and delivery of the ironwork required in their construction, had been laid before them. It was resolved that the tender of Messrs. Moss and Sons, Limited, of Loughborough, for the construction of the tanks, amounting to £12,263, and that of the Horseley Company for the ironwork required, amounting to £1776, be accepted. The Council confirmed the resolution.

Oldham Corporation and the Deanhead Scheme.—The result of a poll of the ratepayers of Oldham which has been taken upon the proposal of the Corporation to obtain parliamentary powers for largely increasing the water supply of the borough, was declared on Tuesday afternoon. It may be remembered that the Corporation desire to promote a Bill enabling them to purchase the water undertaking of the Commissioners of the Deanhead reservoir, and to construct additional works. The increased supply available is calculated to be from 1 to 1¼ million gallons per day. The estimated cost is £320,000, comprising £250,000 for reservoirs, land, and works; £50,000 for mains, &c.; and £20,000 for the purchase of the existing works. The result of the voting was: In favour, 9107; against, 1567—majority in favour of the proposal, 7540.

Opening of London Streets.—The London County Council recently addressed the City authorities on the subject of the opening of the London streets by public and other bodies, and intimated that a letter had been written to the Home Secretary with a view to the appointment of a Select Committee and the holding of an inquiry into the question. The Corporation were asked to co-operate with the London County Council in impressing upon the Government the necessity for taking immediate action in the interests of the public generally. The Streets Committee of the Corporation lately issued a report on the subject, and agreed that the present condition of things requires drastic treatment. They recommended that the Corporation and the London County Council should co-operate in the way proposed, but on the understanding that the authorities at Spring Gardens will take no action in the matter inconsistent with the Corporation's retaining complete and absolute control over the streets of the City. The report came before the Common Council last Wednesday, and was agreed to.

Gas Workers in the Provinces.—The number of persons enumerated at last year's census as engaged in gas-works in the administrative counties of Lincoln, Derby, Norfolk, and Leicester was 382, 698, 285, and 830 respectively.

Dover Water Supply.—A profit of £3300 was made on the water undertaking of the Dover Corporation during the last twelve months; the amount being equal to a reduction of 5d. in the pound on the rates. At Tuesday's Council meeting, the new water-rate was made at 10¾d. in the pound on the rateable value—the same as before.

Salcombe Water Supply.—An inquiry was held at Salcombe, South Devon, on Wednesday week, in regard to an application by the District Council for power to borrow £2000 for works of water supply. The town, which is a resort of visitors in the summer, has of late suffered from a scarcity of water; and the Council propose to construct a new collecting reservoir with a capacity of 42,000 gallons, and to put down an additional oil-engine. It was suggested by the owner of some new property in the district that the source of supply was liable to pollution; but this was denied by the Medical Officer of Health.

Proposed Water Supply for Mere.—The Rural District Council of Mere having applied to the Local Government Board for sanction to borrow £14,500 for the supply of water to East Knoyle, Mere, Sedgehill, and West Knoyle, an inquiry was held recently at Mere by Colonel W. Langton Coke. The scheme proposed was one of pumping from wells; and the available supply was said to be equal to 55 gallons per head per day for a population of about 2590. It was suggested that each of the four parishes affected by the scheme should pay the exact cost of the works executed within its area; and that each parish should be charged *pro ratâ* with the cost of the pumping-station, rising main, and machinery, and also with the working expenses after the scheme had been completed. The estimated cost to each of the parishes was as follows: East Knoyle, £3755; Mere, £6772; Sedgehill, £2442; and West Knoyle, £1531.

Winding-up of the Cromer Water Company.—Arising out of the recent transfer of their undertaking to the Cromer Urban District Council, an extraordinary general meeting of the Cromer Water Company was held a few days ago, under the presidency of the Chairman (Mr. J. Lovelace), to consider the scheme prepared by the Directors' in pursuance of the Cromer Water Act, 1901, for the apportionment of the purchase-money paid by the Council, and other moneys belonging to the Company, among the several classes of shareholders. The Chairman said the matter had been thoroughly thought out; and the Directors had every confidence that an equitable division had been proposed. The scheme was adopted. In the disposal of the reserve fund, after certain payments to the Directors and others, it was decided that the balance should be left with the Board, to be dealt with in remunerating the Secretary (Mr. P. E. Hansell) and the Manager (Mr. J. K. Frost) for their past valuable services, and the rest used in any other way which might seem to them right.

CONCERNING

CONDENSERS,

CONSULT

Richmond's

SIX SIZES.

£6 6 0 to £11 0 0

Fylde Water Board.—Mr. W. O. E. Meade-King, on behalf of the Local Government Board, on Wednesday week held an inquiry at Blackpool into an unopposed application by the Fylde Water Board for approval to borrow £159,407 for the purposes of their undertaking, including the construction of a reservoir to hold 332 million gallons at Grizedale Lea. It was stated that during the past ten years the number of consumers supplied had increased by 90 per cent.

Devonport Corporation and the Water-Works.—In connection with the scheme of the Devonport Corporation for the purchase of the water-works, it was reported to the Town Council on Thursday that a Committee had been appointed to conduct the proceedings in connection with the arbitration, and that Messrs. Alfred Lass, Wood, and Drew had been instructed to investigate the books and accounts of the Company. A Sub-Committee had conferred with Mr. H. Francis, the Engineer and Manager of the Company, and had reported the basis on which he was prepared to negotiate for a continuation of his appointment under the Corporation. The Water Committee came to the conclusion that the basis suggested was not suitable, and resolved to advertise for a Manager. Alderman T. Bowen was appointed Chairman of the Committee.

Road-Watering Charges in Kensington.—At the last meeting of the Kensington Borough Council, a letter was received from the Grand Junction Water Company giving notice that, having regard to the rapidly extending use of water for flushing the roads, in addition to the ordinary watering during dry weather, they propose, from and after the 25th of March next, to charge by meter for all water supplied for these purposes at the rate of 7d. per 1000 gallons, to be reduced to 6d. so soon as the Company shall pay a dividend of 8½ per cent. on their "A" and "B" shares, the present rate on which is 8 per cent. The meters are to be provided and maintained at an annual rate of 30s. each. On the recommendation of the Works Committee, it was resolved that no objection should be offered to the proposal, subject to the rate for the meters including the maintenance of the fittings and stand-posts.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale new issues of debenture and ordinary capital by order of Directors. The first lot consisted of £100 each of 4 per cent. perpetual debenture stock of the South Essex Water-Works Company; and they fetched £112, £112 5s., and £112 10s. apiece. A new issue of £10 ordinary shares in the Great Yarmouth Water-Works Company, ranking for a maximum dividend of 7 per cent. (4 per cent. paid for the past six years), was all placed at par. Last Thursday, the second batch of 2000 £5 shares in the Portsmouth Water Company, authorized by their Provisional Order of the present session, were submitted to public competition by Messrs. Smith, Sapp, and Wyatt. The prices realized ranged from £6 5s. to £6 10s. per share; the larger number being disposed of at the medium figure of £6 7s. 6d. The total amount realized was £12,683 2s. 6d., compared with £12,746 5s. received for the first batch in October.

Reduction in Price.—The Bollington Urban District Council have decided to make a reduction of 2d. per 1000 cubic feet to ordinary meter consumers, and to allow an extra 5 per cent. discount to slot meter consumers, in respect of gas used by them from the 1st prox., with 10 per cent. discount to ordinary consumers. This makes the net price 2s. 6½d. per 1000 cubic feet.

Price of Gas at Newhaven.—The Newhaven Ratepayers' Association, at an adjourned meeting held last week, resolved to petition the Gas Company to reduce the price of gas, as they felt sure that by so doing the Company would find an increase in consumers, and therefore it would be to their interests as well as to those of the users of gas. The petition drawn up concludes with the following delightful sentence: "Your petitioners beg the Company to increase the number of feet now paid for by the slot meter consumers."

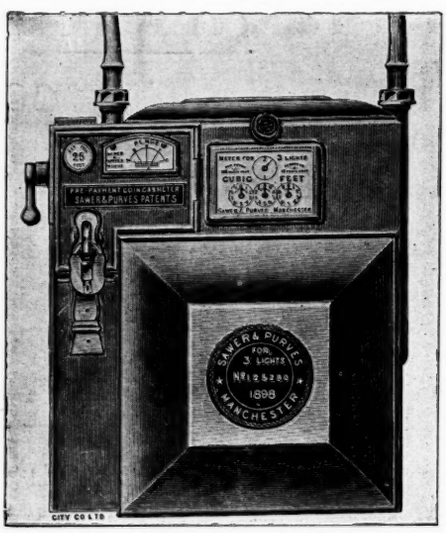
Pure Water Supply and Immunity from Typhoid.—Attention is called in the "Engineering Record" to a striking instance of the value of a pure water supply, furnished from properly arranged works. It was mentioned by Mr. P. Byrne in a paper presented to an American Engineering Association. The supply of a Mississippi town of 1200 inhabitants was obtained from surface wells. During a canvass for and against water-works one August, there were 64 cases of typhoid fever. The advocates of the water-works were successful, and the system was constructed a few months later. In August of the following year, there was not a case of typhoid fever within the limits of supply.

Coventry and the North Warwickshire Water Company.—The Coventry City Council have approved of a report from the Water Committee that application be made to the Local Government Board for a Provisional Order authorizing the Corporation to borrow such sums, in addition to the unexhausted borrowing powers given by the Coventry Water Act, 1889, as might be necessary to enable them to complete the purchase of a portion of the undertaking of the North Warwickshire Water Company, and to carry on the water-works for the next few years. Alderman Drinkwater explained that the Coventry Water Act of 1889 gave the Council power to borrow £100,000; and of this sum £65,000 had been borrowed, leaving £35,000 available. The purchase of the North Warwickshire undertaking had to be completed before the parliamentary session of 1904; and borrowing powers had to be obtained next session. The Council thought it politic not to discuss the financial aspect of the question, in view of the Arbitrators' award not having been received. The Town Clerk said it was possible the Provisional Order would not be required; and in this case it would be withdrawn.

Messrs Joseph Taylor and Co., of Bolton, have received orders for a solid plate lead saturator, delivered and fixed, and a sulphate drainer from the High Wycombe Gas Company; and also for a timber-cased saturator from the Newmarket Gas Company.

FIRST IN 1889

THE POSITIVE DRY



PREPAYMENT METER

FOREMOST EVER SINCE.

SAWER & PURVES,

MANCHESTER.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

SITUATIONS VACANT.

ASSISTANT FOR SOUTH AMERICAN GAS-WORKS. No. 3962.
DRAUGHTSMAN. Gibbons Bros., Dudley.
DRAUGHTSMAN. No. 3951.
ENGINEER AND MANAGER. Reading Gas Company. Jan. 12.
FITTERS. Rotherham Gas Department.
GAS-FITTER. Cambridge Gas Company.
GAS-FITTERS (Six). No. 3963.
MAIN AND SERVICE LAYER. Redditch Gas-Works.
WORKING FOREMAN. High Wycombe Gas Company.
WORKING MANAGER. Wallingford Gas Department. Dec. 29.

SITUATIONS WANTED.

CONSULTING ENGINEER'S OFFICE. No. 3951.
TRAVELLER IN GAS STOVE TRADE. Howland, Faversham.
WORKING MANAGER. Watson, Shepton Mallet.

CONTRACTOR FOR GAS TUBES AND FITTINGS WANTED.

F. G., Liége, Belgium.

GAS ESCAPE INDICATOR FOR SALE (Patent). Medd, Twickenham.

GAS MANUFACTURING PROCESS (Trial Installations).

Masterman, Westminster.

INCANDESCENT MANTLE PATENT FOR SALE. Gasgluhlicht-Gesellschaft, Hamburg.

MORTGAGE BONDS.

SHREWSBURY GASLIGHT COMPANY.

PLANT, &c. (Second-Hand), FOR SALE.

GASHOLDER. Wright, London.
PURIFIERS, SCRUBBER-WASHERS, GASHOLDERS, &c. Firth Blakeley, Dewsbury.
PURIFYING PLANT. Tenby Gas Company.
STATION METERS (2). Oxford Gas-Works.

PUPIL REQUIRED. No. 3960.

SALES OF STOCKS AND SHARES.

NEWCASTLE AND GATESHEAD WATER COMPANY. Jan. 20.
TOTTENHAM AND EDMONTON GAS COMPANY. Jan. 19.

TENDERS FOR

ASH-PANS AND FURNACE FITTINGS.

SHEFFIELD GAS COMPANY. Tenders by Jan. 5.

FIRE-CLAY GOODS.

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.
LEEDS GAS DEPARTMENT. Tenders by Dec. 22.

GASHOLDER.

HINCKLEY GAS DEPARTMENT. Tenders by Dec. 20.

GASHOLDER TANK (Steel).

HINCKLEY GAS DEPARTMENT. Tenders by Dec. 20.

GASKIN (Tarred).

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.

GENERAL GAS-WORKS STORES.

ALLIANCE AND DUBLIN GAS COMPANY. Tenders by Dec. 27.

HYDRAULIC MAINS, ASCENSION PIPES, &c.

SHEFFIELD GAS COMPANY. Tenders by Jan. 5.

IRONMONGERY.

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.

METERS.

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.

RETORT CARBON.

WOOLWICH ARSENAL. Tenders by Dec. 22.

RETORT MOUTHPIECES.

SHEFFIELD GAS COMPANY. Tenders by Jan. 5.

RETORTS.

LEEDS GAS DEPARTMENT. Tenders by Dec. 22.

STEEL AND IRON WORK (Stage Floor, &c.).

SHEFFIELD GAS COMPANY. Tenders by Jan. 5.

STEEL GOODS.

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.

TAR AND AMMONIACAL LIQUOR.

BRIDGEWATER TRUSTEES. Tenders by Dec. 22.
WORKSOP GAS COMPANY. Tenders by Dec. 29.

VALVES AND CONNECTIONS.

HALIFAX GAS DEPARTMENT. Tenders by Dec. 24.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.
JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON HOUSE,
OLD BROAD STREET,
LONDON, E.C.
ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

TO GAS AND WATER OFFICIALS.
HIGH CLASS CYCLES at lowest Prices guaranteed and sent on APPROVAL for Cash or GRADUAL PAYMENTS. Catalogue and Testimonials from Gas Managers post free.
MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IT is worth your while to buy direct. THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Substral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

EERSTE Hollandsche Yzererts Maaty (First Dutch Bog Ore Company, Ltd.), ROTTERDAM.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.
London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

STREET AND SHOP LAMPS AND LANTERNS.
MARK DUFFIELD & SONS (Established 200 Years), makers of Street and Shop Lamps to own Pattern and Design. Any description of Lamp made. Inquiries invited.
London Manager: EDWARD PADFIELD, West India House, 96 & 98, LEADENHALL STREET, E.C.
Telegraphic Address: "EUPATHY, LONDON."

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

PENNY-IN-THE-SLOT WORK.
H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

COAL GAS TAR wanted.
Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.
FIRE Cement, Paint, Mains, Tubes,
STREET LANTERNS, GLASS, TOOLS, &c.
BALE & CHURCH,
5, CROOKED LANE, CANNON STREET,
LONDON, E.C.

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SULPHATE OF AMMONIA
SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

MR. S. J. HOWLAND, late with Messrs. John Wright and Eagle Range, Limited, desires position as TRAVELLER. Good References.
Address 55, Newton Road, FAVERSHAM.

THE Proprietors of a New Process by which Gas can be very profitably MANUFACTURED and SOLD at 3s. 6d. PER 1000 CUBIC FEET in any part of the country, are prepared to equip on trial a limited number of existing installations.—Towns not exceeding 1000 lights preferred—free of charge, and without interference with present lighting system.
Apply to C. E. MASTERMAN, Assoc.M.Inst.C.E., 28, Victoria Street, WESTMINSTER, S.W.

WANTED, re-engagement as Working MANAGER or FOREMAN for Gas-Works. Practical Carbonizer, Fitter, Main and Service Layer, &c. Total Abstainer. Excellent Testimonials and References.
Address G. WATSON, 19, Zion Hill, SHEPTON MALLET.

YOUNG Gentleman who has had very good experience with Contractors for Gas Plant, and who has been in the Office of a well-known Gas Engineer, desires SITUATION with Consulting Engineers. Age 30. Salary moderate.
Address No. 3961, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MAIN and Service Layer (good) wanted. Permanency to suitable Man.
State Age, Wages required, and enclosing *copies* of Testimonials, to ALBERT E. LAYTON, Manager, Gas-Works, REDDITCH.

WANTED, an experienced Draughts- man, capable of taking entire charge of Drawing Office. Must have thorough knowledge of Coal and Coke Elevating and Conveying Plant of all descriptions. Must also be efficient in Retort-House and Gas-Works Plant in general. Commencing Salary £250 per annum.
Apply to GIBBONS BROS., LTD., DUDLEY.

WANTED, a thorough Draughtsman, for a Gas Company near London, capable of Taking out Quantities, Making Estimates, and well acquainted with all kinds of modern apparatus for the Manufacture and Purification of Coal and Oil Gas.
Apply, by letter, stating Age and Salary required, and also give an account of previous training. No. 3951, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CAMBRIDGE UNIVERSITY AND TOWN GAS LIGHT COMPANY.

WANTED, a First-Class Gas Fitter, expert in Gas-Fires and Incandescent Burners.
Apply, by letter, stating Age, Experience, and Wages required, to
JAMES W. AUCHTERLONIE,
Engineer and Manager.

PUPIL.

THE Engineer (M.Inst.C.E.) of a large Provincial Gas Undertaking has a vacancy for a Premium PUPIL. Large extensions now in progress, which will afford exceptional opportunities of gaining a good knowledge of the construction of a modern Works.
Address No. 3960, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for South American Gas- Works, an ASSISTANT (preferably unmarried) having experience in Office Work and knowledge of Gas Manufacture. Three Years' Engagement. Passage out and home free. Salary £300 per annum, with Residence free.
Applications by letter, stating Age and whether Married, Qualifications, and previous Experience, and enclosing *copies only* of recent Testimonials, to No. 3962, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF WALLINGFORD.

THE Gas Committee of the Corporation require the Services of a Competent WORKING MANAGER. Wages £2 per week, with good seven-Roomed House, Garden, Coal, Gas, and Rates free.
Must be a good Mechanic and Carbonizer, able to lay Mains and Services, fix Meters, and effect ordinary light Repairs to the Plant. The Sale of Gas is about 8,500,000 cubic feet per annum.
Applications, with not exceeding three Testimonials, to be sent to the Town Clerk, Wallingford, endorsed "Gas Manager," not later than the 29th of December inst.
Wallingford, Dec. 13, 1902.

HIGH WYCOMBE GAS-LIGHT AND COKE COMPANY, LIMITED.

WORKING FOREMAN.

WANTED, at once, a Working Fore- man. Must be a good Carbonizer, acquainted with Regenerative Settings, Sulphate Plant, and the general routine of a Gas-Works.
Wages 35s. per week, with House, Coal, and Gas, to be increased to 37s. 6d. in Six Months if results are satisfactory.
Applications, stating Age and previous Experience, with two recent Testimonials, to be sent to the undersigned.
HAROLD BAKER,
Secretary and Manager.
Dec. 10, 1902,

READING GAS COMPANY.

GAS ENGINEER AND MANAGER.

THE Directors of the above Company require the services of an experienced GAS ENGINEER and MANAGER.
He must not be less than Thirty nor more than Forty-Five Years of Age, and must have had a thorough practical experience of Gas Manufacture in all its Branches, including the Design and Construction of Modern Gas-Works Plant.
Applications (which will be treated in confidence), stating Salary required, Age, and giving a detailed account of previous Training and Experience, together with *copies* of not more than Four Testimonials, should be sent to me on or before Monday, Jan. 12, 1903, endorsed "Application for Engineer."
Canvassing will disqualify.
By order,
ARTHUR H. CANE,
Secretary.
7, King Street, Reading,
Dec. 9, 1902.

GAS-FITTERS.

SIX First Class Fitters for Automatic Installations in Iron, Wanted at Once. Good Wages; Constant Work.
Apply, by letter, to No. 3963, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE COUNTY BOROUGH OF ROTHERHAM.
(GAS DEPARTMENT.)

WANTED, First-class Fitters. Must be well up in Iron and Compo. work.
Apply, stating Wages, to the undersigned,
FRANK A. WINSTANLEY,
Engineer and Manager.

FIRST-CLASS Belgian Firm require Contractor for best GAS TUBES and FITTINGS.
Address "F. G.," Annonce Metallurgique and Charbourrière, Liége, BELGIUM.

TO BE SOLD—Gasholder, Two Lifts, with Five Columns, 43,000 feet capacity, which can be increased to 49,000 feet if preferred.
Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE—A New Patent Gas Escape INDICATOR, to avoid Gas Explosions or Suffocation.
Apply to G. MEDD, 80, Queen's Road, TWICKENHAM.

PATENTED Process for the Manu- facture of INCANDESCENT GAS MANTLES FOR SALE. Durability and Economy attained, as attested by Official Certificator.
Apply to the GASGLÜHLICHT GESELLSCHAFT, Rubin, m.b.H., HAMBURG.

FOR SALE—Early next Year, Two STATION METERS, each for 30,000 feet per hour, by A. Wright and Co. Cylindrical cases, in good order, now working, with 12-inch Valves and Connections. Suitable for Water Gas.
Can be seen at the GAS-WORKS, OXFORD, on application to the ENGINEER.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TENBY GAS CONSUMERS' COMPANY, LTD.

PURIFYING Plant for Sale, consisting of Four 6 ft. by 6 ft. by 3 ft. 6 in. BOXES, and 6-inch Centre-Valve and Connections, and Two 5 ft. square by 3 ft. CATCH BOXES and Two FOUR-WAY VALVES and CONNECTIONS.
For further Particulars and Price, apply to the undersigned.
ALFRED H. BROOKMAN.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and the AMMONIACAL LIQUOR made at their Works from the 1st of January to the 31st of December, 1903.
Tenders for Tar to state price per Ton delivered into Purchaser's Tanks at the Worksop Railway Station.
Tenders for Liquor to state price per Ton, as tested by No. 1 Twaddel Hydrometer, delivered into Boats near the Company's Works, or price per Ton delivered into Purchasers' Tanks at the Railway Station.
The Directors do not bind themselves to accept the highest or any Tender.
Tenders to be sent in by the 29th of December.
Worksop, Dec. 8, 1902.

SHREWSBURY GASLIGHT COMPANY.

MORTGAGE BONDS.

THE Directors are prepared to accept sums of £100, or multiples thereof, on MORTGAGE BOND, specially secured by Act of Parliament upon the Company's Property and Revenues, at £3 10s. per cent. per annum, repayable at the end of one year, or afterwards subject to Six Months' Notice on either side. Other periods may be arranged to suit lenders.
Interest payable half yearly, at Lady-day and Michaelmas.
Apply to the SECRETARY,
Gas Offices,
Shrewsbury.
Nov. 1, 1902.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Hali- fax Corporation invite TENDERS for the supply of:
(1) IRONMONGERY.
(2) STEEL GOODS.
(3) FIRE-CLAY GOODS.
(4) IRON VALVES AND CONNECTIONS.
(5) WET AND DRY GAS-METERS.
(6) TARRED GASKIN.
(7) CLOTHING AND CAPS.
Required during the ensuing Twelve Months.
Forms of Tender and Further Particulars may be obtained on application to Mr. Thomas Holgate, M.Inst.C.E., Engineer, Gas-Works, Halifax.
Tenders endorsed "Gas-Works" together with the names of the articles tendered for, must be sent to the undersigned not later than Twelve o'clock noon on Wednesday, Dec. 24, 1902.
The persons whose Tenders are accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.
The Committee do not bind themselves to accept the lowest or any Tender.
By order,
KEIGHLEY WALTON,
Town Clerk.

THE Bridgewater Trustees are prepared to receive TENDERS for the TAR produced at their Coke-Works for a period of Six or Twelve Months from the 1st of January next, delivered into Contractor's Tanks at the Trustees' Brackley Siding on the Little Hulton Mineral Branch of the L. & N. W. Railway, or their Wharton Hall Siding on the Pendleton and Hindley Branch of the L. & Y. Railway.
The estimated quantity for the Twelve Months is 2500 Tons; and Tenders, endorsed "Tender for Tar," addressed to the Bridgewater Trustees, 4, Chapel Walks, Manchester, should be delivered on or before the 22nd of December.

HINCKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council are prepared to re- ceive TENDERS for a GASHOLDER and STEEL TANK.
Drawings may be seen and Specification, with Form of Tender obtained, from the Engineer and Manager, Mr. Fred Lee, on payment of One Guinea, which will be returned upon receipt of a *bonâ-fide* Tender.
The Council do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Gasholder," to be sent to me on or before Saturday, Dec. 20, 1902.
A. S. ATKINS,
Clerk.
Hinckley, Dec. 5, 1902.

WAR DEPARTMENT CONTRACTS.

TENDERS are required for the Sale by the War Department of about Fifty Tons of RETORT CARBON at the Gas Factory, Royal Arsenal, where it can be seen.
The Carbon will be loaded free into Trucks on the Royal Arsenal Railway Sidings, or in Barges alongside the Royal Arsenal Wharves.
Forms of Tender will be issued on application to the Superintendent, Building Works, Royal Arsenal, Woolwich, not later than Monday, the 22nd day of December, 1902.
M. T. SALE, C.M.G., Colonel (Ret.),
Superintendent, Building Works.
Royal Arsenal, Woolwich,
Dec 4, 1902.

CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the Leeds Cor- poration are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.
Specification and Form of Tender may be obtained on application to the undersigned.
Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Fire Goods," must be delivered at the Gas Offices, Municipal Buildings, Leeds, not later than Monday, the 22nd inst.
The Committee do not bind themselves to accept the lowest or any Tender.
R. H. TOWNSLEY,
General Manager.
Gas Offices, Leeds,
Dec. 8, 1902.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Iron Founders, Gun Barrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to the 31st of December, 1903.
Samples of Goods required are open to inspection on the Works, Great Brunswick Street, and printed lists of Articles required can be had on application at the Company's Offices, D'Olier Street.
Tenders, endorsed "Tenders for Stores," to be lodged in my Office, on or before the 27th inst.
FRANCIS T. COTTON,
Secretary.
Head Offices, D'Olier Street, Dublin.
Dec. 12, 1902.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK ONLY, WILL BE CLOSED on the 17th inst., and RE-OPENED on the 1st of January, 1903.
By order of the Board,
WILLIAM E. ROBERTS,
Secretary.
63, Chancery Lane,
Dec. 16, 1902.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

MINIMUM PRICE £102 PER CENT.

SALE BY TENDER OF £7500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

IN pursuance of the Tottenham and Edmonton Gas Act, 1898, Notice is Hereby Given that it is the intention of the Directors of this Company to SELL BY TENDER £7500 of the above DEBENTURE STOCK, to be paid up in full on or before the 31st of January, 1903, such Stock being a portion of Additional Capital authorized to be raised by Resolution passed at an Extraordinary General Meeting of the Proprietors held on the 24th day of February, 1900, under the powers of the above-mentioned Act.
Particulars and Conditions, and Form of Tender, may be obtained on application at this Office, and sealed Tenders must be sent in not later than Four o'clock in the afternoon of Monday, the 19th of January, 1903.
By order of the Directors,
JAMES RANDALL,
Secretary.
Chief Office of the Company,
639, High Road, Tottenham,
Dec. 12, 1902.